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SUMMARY OF PURPOSE

Sherwood Design Engineers (SDE) has conducted a general assessment of the City of Fresno's wet utility systems and resources. The findings below are meant to inform the team in its development of the Fresno Fulton Corridor Specific Plan and Downtown Neighborhoods Community Plan.

KEY FINDINGS

A summary of findings pertinent to the City of Fresno's water resources are:

- Current water consumption trends are straining the City's available water resources, highlighting the need for increased conservation measures and the development of alternative water resources.
- Much of the existing water distribution system is over 50 years old, and improvements are needed to strengthen the sufficiency and reliability of aging infrastructure.
- Projected population growth and densification also require improvements to the water supply and distribution system to provide adequate fire flow.
- Sewer capacity upgrades are also needed to accommodate the projected population growth and associated wastewater demand increases.
- To offset water demand for non-potable uses, plans are currently underway to expand and further establish the City's Recycled Water System, including the installation of tertiary treatment facilities.
- The downtown area is characterized by large impervious areas, is susceptible to localized flooding, and could benefit from additional local detention facilities to mitigate flood hazards.

GENERAL BACKGROUND AND CONTEXT

The City of Fresno is located in northern Fresno County, California, approximately midway between Bakersfield and Sacramento in the San Joaquin River Valley. The areas encompassed by the Fresno Fulton Corridor Specific Plan and Downtown Neighborhoods Community Plan are shown in Figures 1 and 2. The City is located near the headwaters of the San Joaquin and Kings Watersheds, from both of which it currently imports surface water to augment its groundwater supplies.

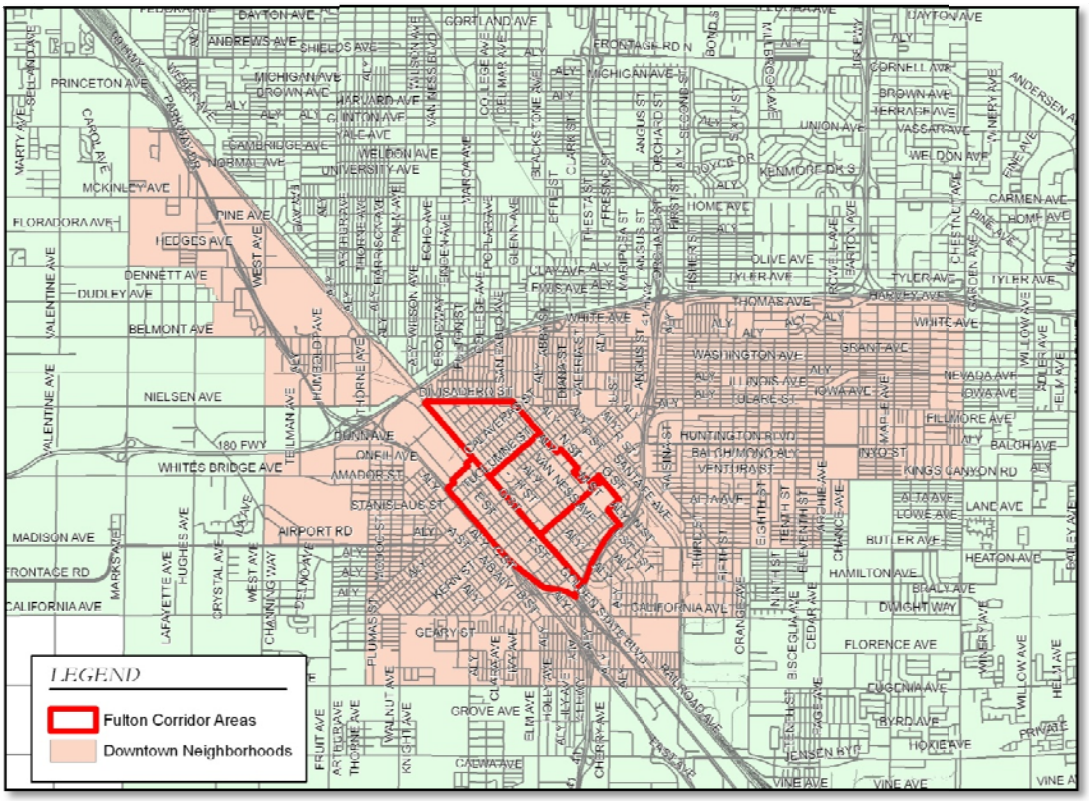

Figure 1. LOCATION MAP

Figure 2. FULTON CORRIDOR SPECIFIC PLAN AREA - AERIAL MAP

CLIMATE AND GENERAL HYDROLOGY

General

- Fresno has a semi-arid Mediterranean climate with an average annual precipitation between 6-11 inches per year; however the area is subject to wide variations in annual precipitation.
- The majority of precipitation occurs during winter months (November through April).
- The City is dependent upon precipitation and run-off from Sierra Nevada snow pack to recharge groundwater supplies and provide surface water for irrigation.
- A large productive aquifer system exists beneath the study area at depths ranging between 159 to 900 feet below the ground surface for most of the area, and generally becomes shallower towards the north and east.

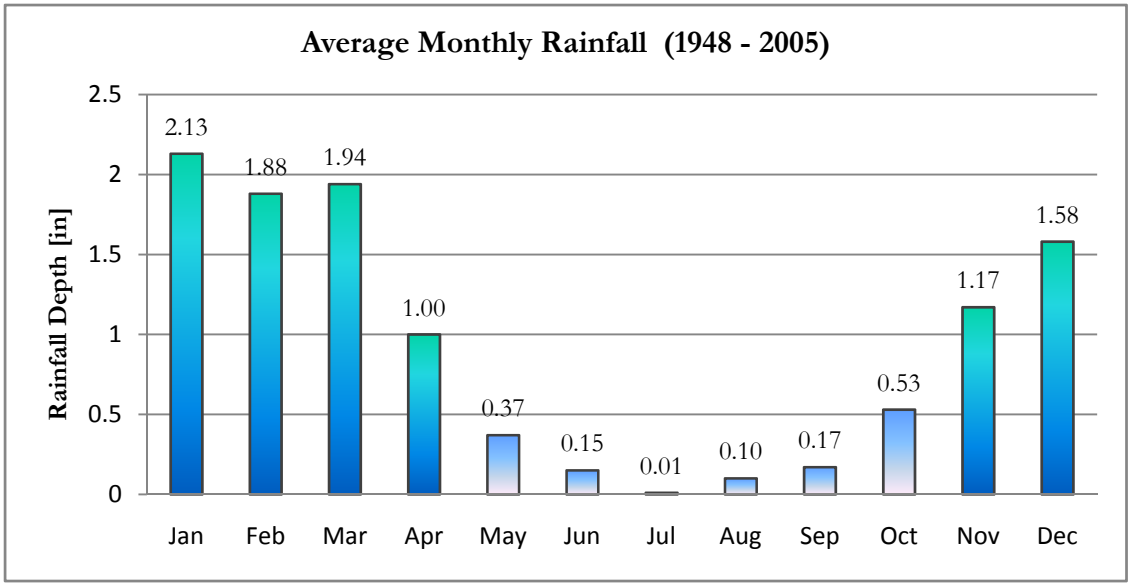

Figure 3. FRESNO AVERAGE MONTHLY RAINFALL

WATER RESOURCES

The City of Fresno currently acquires all of its potable water from local groundwater sources and imported surface water sources. These sources and their issues are listed below, as provided by the *City of Fresno Final Urban Water Management Plan, 2008 (UWMP)* and the *Metropolitan Water Resources Management Plan, 2010 (MWRMP).* A discussion of the amount of water currently available from these sources as related to water use, demand, and associated conservation needs also appears in subsequent sections.

Groundwater

- Depending on groundwater conditions, the City operates 250 to 265 municipal supply wells that access groundwater from the Kings Sub-basin of the San Joaquin Valley Groundwater basin and a 30 mgd surface water treatment facility (NESWTF).
- Three active wells—PS3A, PS21A, and PS22A—are located near or within the central downtown Plan Area. These wells are prone to sanding, air entrainment, and general failure due to receding groundwater levels.
- Geologic aquifer conditions are ideal for production, with high transmissivity and high surface infiltration potential.
- Groundwater overdraft is an issue and levels have declined an average of 1.5 feet per year since 1990.
- Water quality generally meets primary and secondary drinking water standards for municipal use, with good natural conditions for total dissolved solids.
- Potential chemical contamination exists throughout the City and downtown with the presence of DBCP, EDB, TCP, TCE, PCE and nitrate found in water quality tests. These contaminant plumes pose a threat to the drinking water supply and can be mitigated through the introduction of advanced treatment measures.
- Thirty-one City wells already use advanced treatment, such as granular activated carbon, air stripping, and other measures to remove contaminants.
- 2009 Groundwater Pumped: 138,254 AFY
- Natural recharge:
    - 2009 Percolation: 17,000 acre-feet/year (AFY)
    - 2009 Seepage: 15,500 AFY
    - 2009 Subsurface Boundary Inflow: 21,100 AFY
    - 2009 Total: 53,600 AFY

  Long-term projections per the 2010 MWRMP estimate that future natural recharge will remain steady at 53,600 AFY.
- Intentional Recharge: Over the last 25 years, several agencies have worked to intentionally recharge the groundwater supply through a system of recharge basins. The City of Fresno has recharged an average of 44,200 AFY. The City intends to increase this number to account for increased draws on the groundwater supply.
- Overdrafting: The City has operated an unbalanced groundwater program since 1990, pumping a cumulative 785,000 AF more than it has recharged over twenty years. This has resulted in groundwater level declines, a reduction in groundwater basin storage, potential

groundwater quality degradation, and unnecessarily elevated operating costs due to energy consumption.

Surface Water

- Available surface water supplies are treated at the City's 30 mgd NESWTF located in northeast Fresno.
- The City receives high quality surface water from Fresno Irrigation District (FID) Kings River contract. In 2010, the amount of water available to the City exceeeded 105,000 AFY. Although this will increase over the next 20 years as the City annexes additional land, available surface water will ultimately be limited by the proposed densification of existing land within the current boundaries of the City to provide growth.
- The City receives 58,200 AFY of high quality surface water from the San Joaquin River via the Friant-Kern Canal under a contract with the U.S. Bureau of Reclamation (USBR), which represents 97% of the 60,000 AFY entitlement. This entitlement depends on water year conditions, with the City receiving the full 60,000 AFY only in favorable water years. 20% of this supply (12,000 AF) is subject to the terms of the San Joaquin River Restoration Settlement.
- The City also has a commitment of 10,000 AFY of potential flood release water (Section 215 releases) from the Friant Dam, which is available whenever the Army Corps of Engineers needs to release water to provide storage behind the dam. This water supply is discounted below the price of normal delivery water and can be increased during wet years. Due to the extremely cool, wet year in 2010, the City was offered up to 100,000 AF, but was unable to accept the water due to the lack of conveyance and storage capacity.
- 13,800 AFY is available on average from FID in a normal year through the City's Wastewater Recycle Exchange.
- Approximate Total Surface Water Available: 179,000 AFY
    - Treated at NESWTF for Potable Use: 22,000 AFY
    - To Recharge Basins & Agriculture within FID: 157,000 AFY

Water Demand

The existing average water use for the City is 300 gallons per capita per day (gpcd). As shown in Figure 4, per capita water use in Fresno is higher than in its neighboring municipalities and therefore demonstrates an opportunity for increased water conservation.

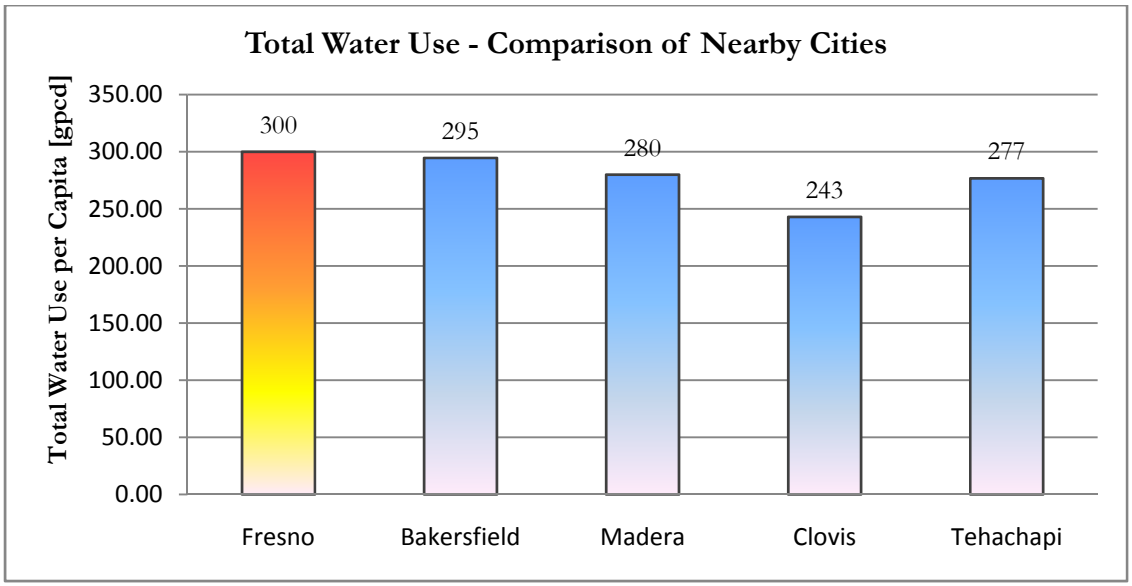

Figure 4. TOTAL WATER USE – COMPARISON OF NEARBY CITIES

In 2007, single-family and multi-family residential users accounted for over 65% of the City's total water demand, at 85,285 AFY and 23,529 AFY respectively. Since the majority of the City's residential customers are currently unmetered, these statistics are estimated based on assumptions about average leakage losses and unaccounted for water uses, such as flushing and fire flows. Figure 5 shows the distribution of overall water demand for different sectors in 2007. Total demand was 165,798 AFY in 2007, dropping to 157,817 afy in 2009, and is projected by the 2008 Urban Water Management Plan to reach 233,400 AFY by 2025. This projection includes conservation savings that will be achieved by the year 2025.

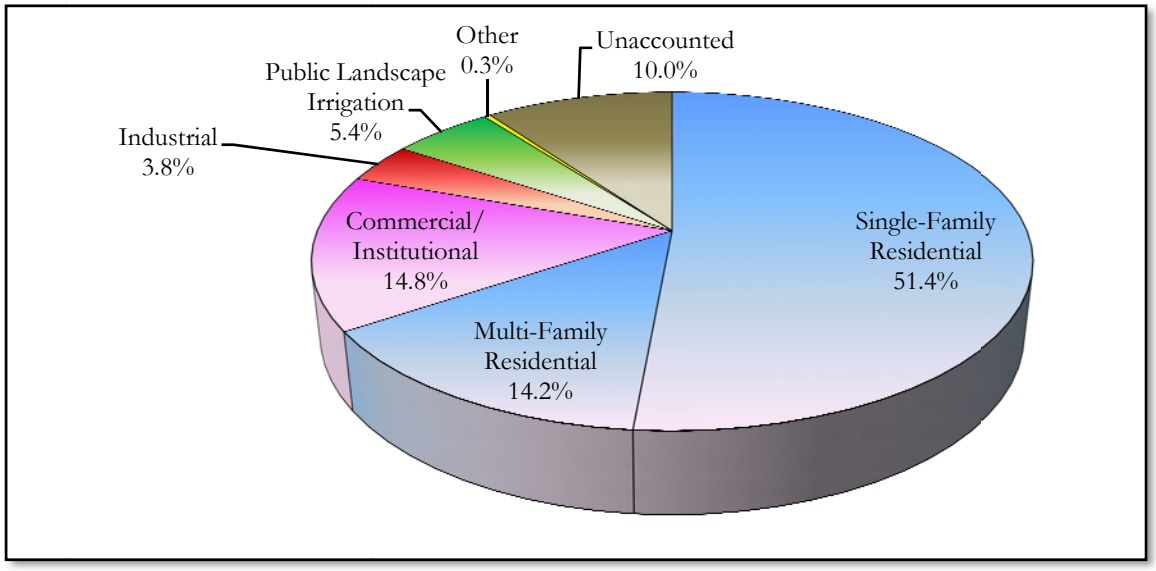

Figure 5. 2007 FRESNO WATER DEMAND BREAKDOWN

The Fulton Corridor Specific Plan Area is not representative of the water use distribution for the City as a whole, since the area is primarily commercial consisting of a retail core and a substantial amount of office space. The area is characterized by ageing pipes prone to leakage losses that are likely higher than the assumed City average. Older buildings in the area also rely on water coolers that are supplied by domestic water or private wells, both of which threaten the groundwater table. In addition, the Plan Area includes parks, public buildings and many professional offices that have been converted from residential dwellings. It is also important to note that the housing stock within the Plan Area generally has a much higher density than the City as a whole. Although higher density housing typically has lower per capita water use than less dense neighborhoods, total demand per acre is generally higher because there are more homes. Therefore, the presence of commercial, institutional and denser residential land uses suggests that water demands in the Plan Area are higher than the City average.

City-wide Total Projected Supply v Demand

2025 Total Available Supply: 252,100 afy

2025 Total Demand (no conservation): 260,400 afy

2025 Total Demand (10% conservation): 234,400 afy

The MWRMP found the City's future water supply portfolio to be sufficient to meet 2025 demands, projected as 234,400 AFY for buildout conditions as defined in the General Plan and assuming 10% conservation savings. This assessment reflects the City's plans to progressively decrease dependence on groundwater, while increasing the availability of both treated surface water and recycled water resources, and bolstering conservation savings. In conjunction with changes to current water supply

management policies, the City plans to implement measures to accommodate the 2025 projected population, such as:

- Shift from single family units to smaller footprint multi-family units.
- Restructure water conservation policies to include more financially compelling incentives for customers and developers.
- Incorporate tertiary-treated recycled water into its future water supply portfolio to offset water demands.

It should be noted that any densification surpassing the buildout conditions defined in the 2025 General Plan, such as significant additional downtown residential development, cannot be addressed by conservation measures alone, and will require allocating additional water resources. The required supplemental water should be met by further capacity improvements to surface water and reclaimed water supplies, rather than reverting to elevated groundwater extraction rates. As discussed in the MWRMP, the City plans to identify and acquire potential new water supplies via additional surface water from FID and the proposed Temperance Flat Dam, groundwater banking, open market water purchases, and expanded recycled water in order to ensure adequate water supply through the year 2050.

Existing Water Conservation Measures

The City has an active and successful history of water conservation, beginning as early as 1917 and gaining particular momentum following the 1976-77 drought. However, given the City's per capita water use compared to similar California cities, there is room for improvement. Despite extensive community outreach efforts, monitoring, and complimentary audits, customers have not been incentivized to conserve without being offered more tangible economic incentives. For example, the City's meter pilot program identified 70% of the customers in the program as having leaks and almost none of them fixed the leaks, because with the flat rate there is no monetary incentive to spend the money to fix them.

The City's current Water Conservation Plan was completed in 2005 and includes:

- Voluntary Water Survey Program for single-family and multi-family residential customers.
- Voluntary Residential Plumbing Retrofits provide low flow showerheads and faucet aerators to City customers upon request and at public outreach events.
- System Water Audits, Leak Detection and Repair performed in 1998, 2004 and 2013.
- Mandatory Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections, require meters to be installed by 2013 and residential billing to begin in 2010, with no commodity rates currently implemented.
- Large Landscape Conservation Programs and Incentives offer landscape surveys, instate permits for large landscapes that require excessive watering, and added landscape conservation requirements to the Municipal Code.
- High Efficiency Washing Machine Rebate Programs in place.
- Public Information Programs in place.
- School Education Programs for K-12 and college.

- Conservation Programs for Commercial, Industrial, and Institutional Accounts provide voluntary surveys and require water conserving devices.
- Conservation Pricing to be implemented in 2013 when meters are in place; no specific tiered billing structure in place.
- Water Conservation Coordinator designated as a full-time Water Conservation Program Coordinator.
- Water Waste Prohibitions incorporated into City Municipal Code.
- Residential Ultra-Low-Flush Toilet Replacement Programs in place since 2006.

In May 2010, Sherwood Design Engineers prepared a memorandum that analyzed the impacts of these conservation measures on sustainability and identified opportunities for implementing additional sustainable policies. The document, entitled *City of Fresno Policy Evaluation for Sustainability*, is included as Appendix A.

WATER DISTRIBUTION

The City's potable water transmission and distribution system consists of:

- Distribution System. A 1,740 mile pipe network ranging in size from 6 inches to 14 inches in diameter that serves individual customers.
- Transmission Grid Main (TGM) System. 16 inch diameter water mains that convey potable water to the distribution system.
- Regional Transmission Main (RTM) System. Pipes 24 inches in diameter or greater that convey water from the Northeast Surface Water Treatment Facility (NESWTF) to the TGM.

Water is supplied from up to 265 operational groundwater wells, a 30 mgd NESWTF, storage facilities, and booster pump facilities. A 60 inch raw water gravity main is also being constructed from the Friant-Kern Canal, one mile of which is already completed. There is over 40-feet of elevation difference between the outlet from the Friant-Kern Canal into the 60-inch raw water pipeline and the lower elevation outlet to the headworks of the NESWTF. Currently the Department of Public Utilities – Water Division is planning to construct a low-head hydropower generation plant on the low-end of the pipeline at the NESWTF to take advantage of the elevation difference and provide alternative energy electrical power directly for the operation of the NESWTF The distribution system is divided into four quasi-pressure zones to help regulate minimum and maximum system pressures in the various topographic areas of the City.

The Central Area, which includes Fulton Corridor, relies on a large number of six-inch water mains over 50 years old that cannot provide appropriate fire flow according to current fire flow standards. In 2009 West Yost and Associates completed a Hydraulic Evaluation of the Central Area comparing current conditions and projected additional water supply needs based on incremental growth according to the 2025 General Plan. The evaluation included a water model and master planning of water supply and major water transmission infrastructure projects. The evaluation also studied maximum day demand including fire flow for 2009 conditions, and found that the Central Area retains an approximate supply deficit of 1,200 gallons per minute (gpm). For peak hour demand without fire flow requirements, the supply deficit is approximately 800 gpm.

In order for the entire Central Area to meet the fire flow demands of existing and anticipated future development, additional 12 and 10-inch diameter pipelines will need to be constructed. A vulnerability analysis also revealed the need for additional supply to increase reliability, which was achieved by a plan to upgrade Well 172 to full capacity and construct transmission mains from Well 172 to the Downtown. The distribution system improvements would include approximately 5,270 feet of 16 inch diameter pipeline south along Hughes Avenue and approximately 9,050 feet of 24 inch diameter pipeline along Nielsen Avenue to convey the additional capacity of 1,500 gpm from Well 172 to Fulton Corridor. Additionally, a 3 million gallon tank has been planned for the Central Area of the City, which falls into the Fulton Corridor Plan Area. This tank is intended to supplement the main distribution system in order to provide for peak demands and required fire flow. Recent analysis has identified Well 172 as an operationally critical system component; while the new tank and main provide some safeguard in the event Well 172 fails, the water system would still be unable to meet demands with fire flow included for the downtown area. The existing water system and proposed improvements are shown in Figure 6.

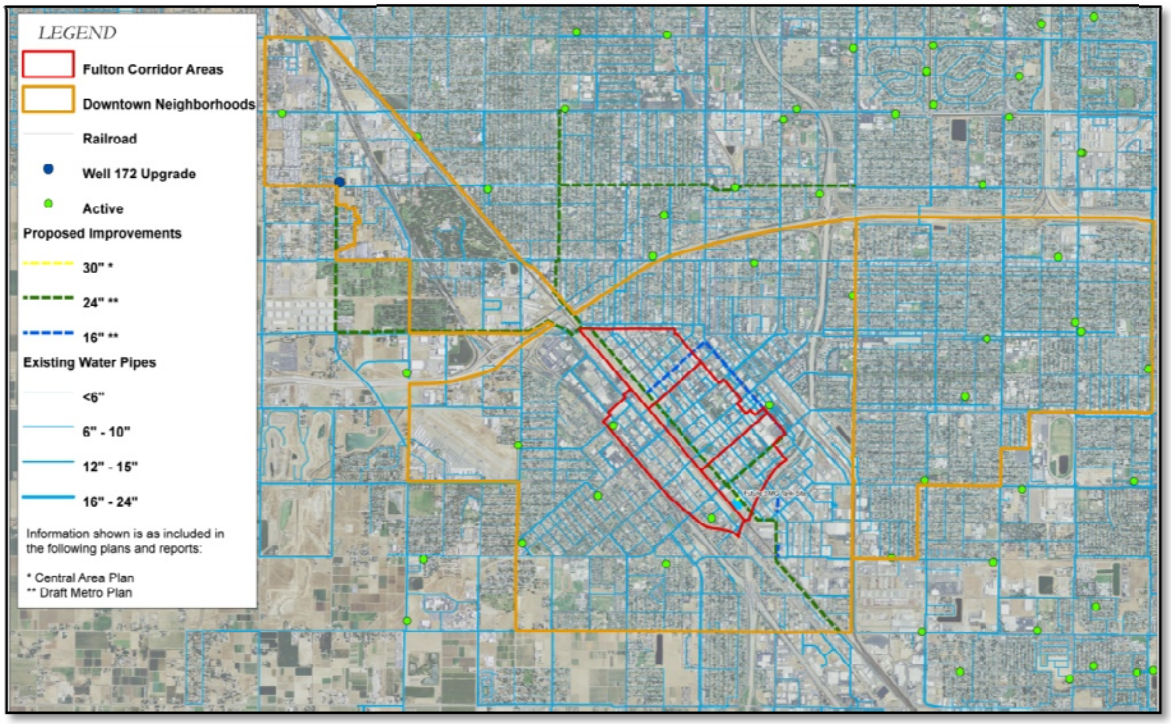

Figure 6. EXISTING WATER SYSTEM AND PLANNED IMPROVEMENTS

WASTEWATER

The City of Fresno is the Regional Sewer Agency for the Fresno-Clovis Metropolitan Area (FCMA), and owns and maintains the wastewater collection system that serves the City and the following agencies: County of Fresno, City of Clovis, Pinedale Public Utility District, and Pinedale County Water District. The City's wastewater collection system consists of 23,005 manholes, 15 lift stations, nearly 2 miles of force mains, 54 junction structures, and approximately 1,498 miles of gravity sewer pipes ranging from 6" to 84" in diameter. The City also owns and operates the Fresno/Clovis Regional Wastewater Reclamation Facility (RWRF), shown in Figure 7. The RWRF provides secondary wastewater treatment via primary settling and secondary sludge removal processes.

The wastewater collection system conveys wastewater primarily by gravity to the RWRF located southwest of the City limits. Generally, wastewater flows from the northeast to the southwest. The RWRF currently provides secondary treatment and has a rated capacity of 80 mgd, with equipment redundancy to accommodate maintenance schedules or equipment failures. Effluent disposal occurs primarily through a combination of infiltration beds located at the RWRF and agricultural irrigation.

According to the 2025 General Plan, the City's population will increase from about 482,000 in 2000 to 790,000 in 2025. The growth will occur through population densification as well as new developments. The collection system must be expanded to handle the resulting increased flow within the City's current collection system and to provide service to new developments. These improvements would supplement the City's on-going program to address the age and existing challenges in the collection system, notably the corrosion of existing concrete sewers due to high sulfide levels. Assuming a treatment design demand of 130 gpcd, the RWRF would need to provide a base treatment capacity of 103 mgd to serve the projected population in 2025. While the RWRF facility is the regional treatment and reclamation facility, alternatives for future capacity include sub-regional facilities located in one or both of the North and Southeast Growth Areas presented by the 2025 Fresno General Plan.

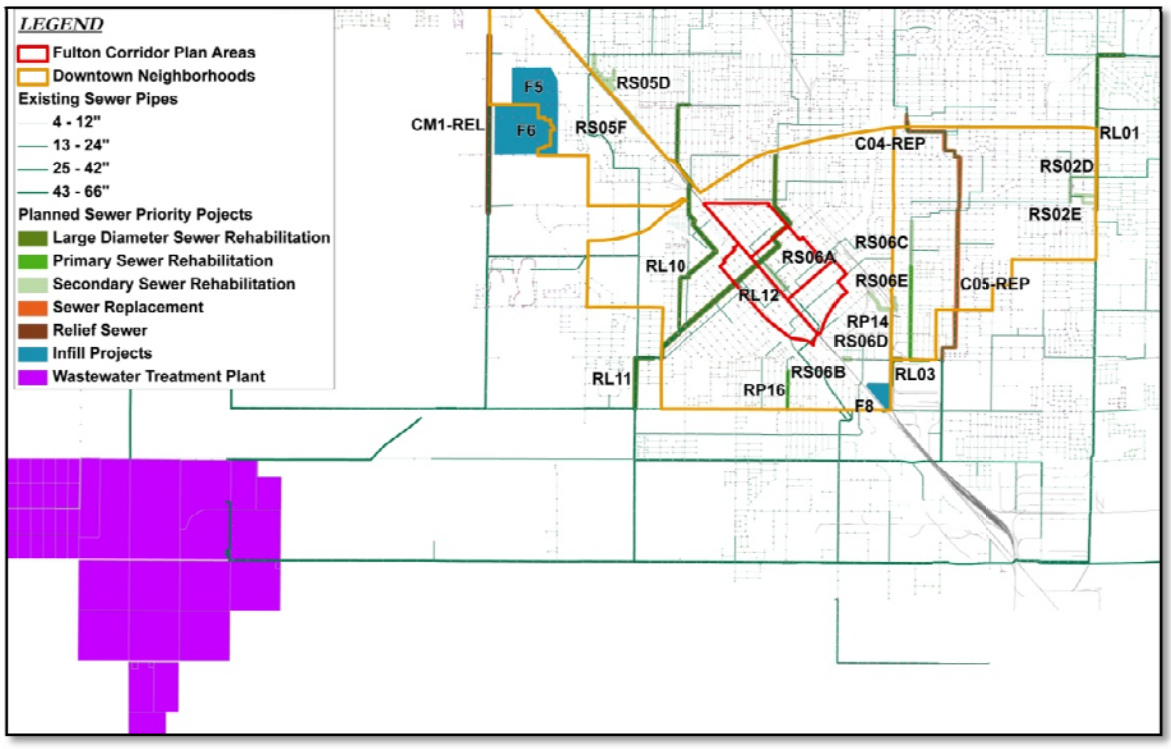

Figure 7. EXISTING SEWER SYSTEM AND PLANNED IMPROVEMENTS

Figure 7 shows the existing wastewater collection network and improvements planned by the City based on its 2006 Wastewater Collection System Master Plan. These improvement projects fall into several different categories:

- **Infill Projects** are generally planned for developed areas in which no sanitary sewer service is currently available, where existing infrastructure has been abandoned or where residents rely on septic systems for wastewater treatment and disposal. Infill projects also include areas served by existing sewer trunks and mains. These projects are required by City ordinance to protect groundwater from nitrate contamination. Growth infill projects are for partially developed areas where the City expects additional growth to occur.

- **Sewer Replacement Projects** provide the necessary sewer capacity by the removal of deficient sewer facilities and the construction of replacement sewer facilities providing the additional capacity.

- **Rehabilitation Projects** consist of sewer improvements planned for existing sewers to halt and remedy the effects of sulfide-related pipe corrosion via the installation of cured-in-place pipe (CIPP) liner. In general, the existing pipe materials consist of reinforced concrete pipe (RCP), non-reinforced or standard concrete pipe (NRCP or SCP), and asbestos-cement pipe (ACP), all of which are susceptible to sulfide-related corrosion processes. These projects are further differentiated as "Primary", "Secondary", or "Large Diameter".

The City commissioned an evaluation that was completed in 2001 of its then-existing concrete sewers ranging from 12 to 27 inches in diameter. Primary sewer rehabilitation recommendations were made for approximately 14.5 miles of these sewers, generally those found to be in "severe" condition, with a total estimated rehabilitation cost of $11.1 million. The primary sewer rehabilitation recommendations included 16 separate projects, presented in order of priority. Since the time of the 2001 evaluation, the City has implemented Primary Rehabilitation Priorities No. 1 through No. 11. The remaining projects, Primary Rehabilitation Priorities No. 12 through No. 16, are planned for implementation as part of the Capital Improvement Program. Secondary sewer rehabilitation recommendations were made for approximately 18.4 miles of the evaluation sewers, generally those found to be in "moderate" condition, with a total estimated rehabilitation cost of $11.0 million.

- **Relief Sewer Projects** provide supplemental sewer capacity by the construction of parallel sewer facilities that function in combination with the existing sewer facilities.

Planned sewer improvements within the Downtown Neighborhoods area are summarized in Table 1. Some of these improvement projects have already been completed or are underway.

CM1-REL	Relief Sewer	33" PVC Marks Ave (Nielsen Ave to McKinley Ave)
F5	Infill Projects	8" PVC Pine Ave, Crystal Ave, Belmont Ave, Pleasant Ave
F6	Infill Projects	8" PVC Alhambra Ave, Hughes Ave, Belmont Ave, Monte Ave
F8	Infill Projects	8" PVC Florence Ave, East Ave, Railroad Ave
RL03	Large Diameter Sewer Rehabilitation	21" CIPP, 30" CIPP East Ave (Florence Ave to California Ave) California Ave (East Ave to Third St)
RL10	Large Diameter Sewer Rehabilitation	27" CIPP, 30" CIPP Modoc St, San Joaquin St, E St, Trinity St, Weber Ave, Harrison Ave, Webster Ave
RL11	Large Diameter Sewer Rehabilitation	48" CIPP, 54" CIPP Fruit Ave (Church Ave to California Ave) California Ave (Fruit Ave to Arthur Ave)
RL12	Large Diameter Sewer Rehabilitation	24" CIPP, 48" CIPP Thorne Ave, Merced St, Van Ness Ave, Toulumne St, N St, Glenn Ave
RP14	Primary Sewer Rehabilitation	12" CIPP, 16" CIPP, 18" CIPP California Ave (Fifth St to Third St) Third St (California Ave to El Monte Way)
RP16	Primary Sewer Rehabilitation	18" CIPP Elm Ave (Church Ave to Lorena Ave)
RS02D	Secondary Sewer Rehabilitation	21" CIPP Sierra Vista Ave (Iowa Ave to Washington Ave) Washington Ave (Sierra Vista Ave to Chestnut Ave)
RS02E	Secondary Sewer Rehabilitation	12" CIPP, 15" CIPP Illinois Ave (Sierra Vista Ave to Chestnut Ave) Recreation and Iowa Aves (Illinois to Chestnut)
RS05D	Secondary Sewer Rehabilitation	12" CIPP Brooks Ave (McKinley Ave to Weber Ave) Weber Ave (McKinley Ave to Lamona Ave) Floradora Ave, Teilman Ave
RS05F	Secondary Sewer Rehabilitation	12" CIPP Weber Ave (Hammond Ave to Vagedes Ave)
RS06A	Secondary Sewer Rehabilitation	18" CIPP, 21" CIPP H St (Fresno St to Kern St)
RS06B	Secondary Sewer Rehabilitation	15" CIPP California Ave (Cherry Ave to Van Ness Ave)
RS06C	Secondary Sewer Rehabilitation	16" CIPP Third St (El Monte Way to Kerckhoff Alley)
RS06D	Secondary Sewer Rehabilitation	21" CIPP East Ave (California Ave to E Butler Ave)
RS06E	Secondary Sewer Rehabilitation	12" CIPP, 21" CIPP Walker Ave, E Butler Ave, S Parallel Ave, Topeka Ave

Table 1. PLANNED SEWER IMPROVEMENTS

Recycled Water

Except for incidental and evaporative losses, the total wastewater volume treated at the RWRF is currently used to either directly irrigate farmland or sent to incidental percolation basins. After this water percolates into the groundwater basin, a portion of this water is then pumped and discharged into the FID canal system as part of the Wastewater Recycle Exchange Agreement with FID. Citywide recycled water use in 2005 was 65,300 AFY. The City plans to expand its recycled water use to include landscape irrigation and non-potable applications, which would require the construction of additional tertiary treatment facilities. The expansion of the recycled water system is described in the City's Recycled Water Master Plan (RWMP) and would enable the City to offset potable water use, enhance the sustainability of the water supply, and reduce current dependency on percolation ponds to handle effluent discharge. As part of the RWMP, the City intends to adopt a Recycled Water Ordinance to further support recycled water development by encouraging, or in some instances, requiring recycled water use. An example that demonstrates the potential success and benefit of increased recycled water reuse is the newly completed water reclamation facility (WRF) in northern Fresno. This WRF provides disinfected tertiary treatment for wastewater that will be used to irrigate the Copper River Ranch development and golf course, thereby decreasing current dependency on FID water. Components of the RWMP are shown in Figure 8.

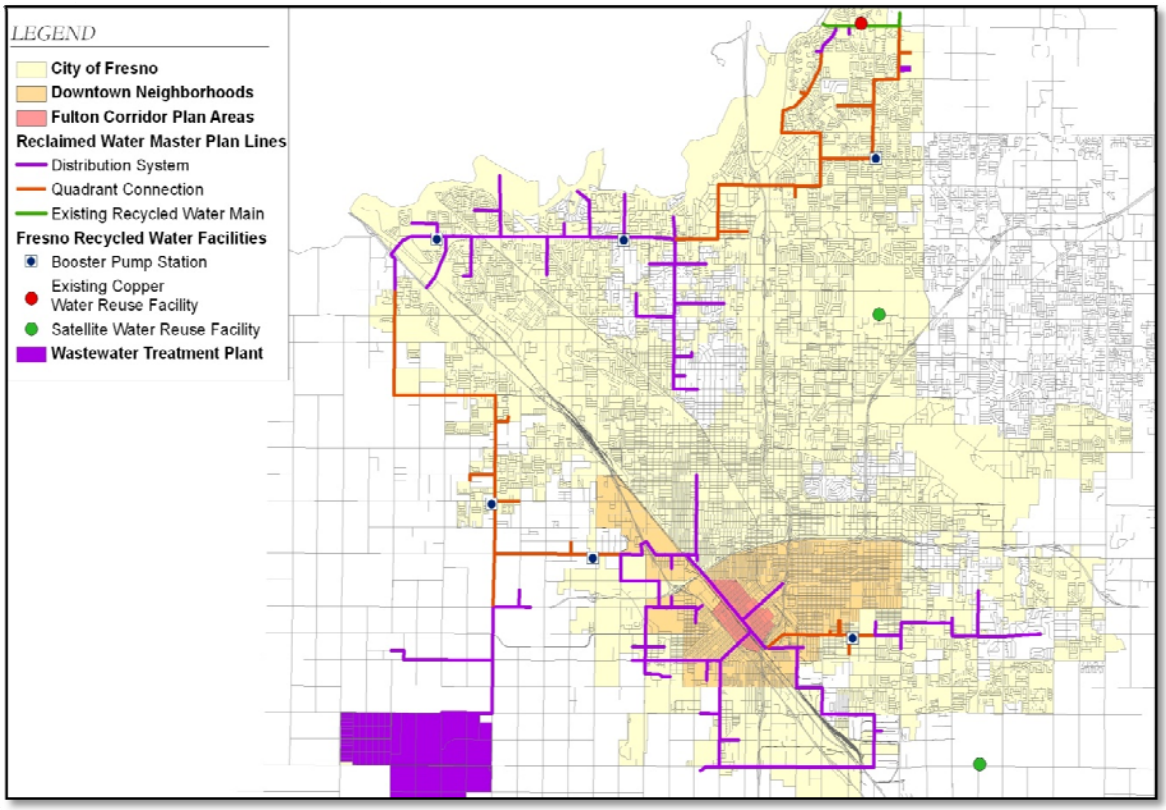

Figure 8. RECYCLED WATER MASTER PLAN

STORMWATER AND DRAINAGE

The Fresno Metropolitan Flood Control District is responsible for managing urban stormwater runoff in the Fresno metropolitan area. The District is located in the north-central portion of Fresno County between the San Joaquin and Kings rivers and is authorized to control storm waters within an urban and rural foothill watershed of approximately 400 square miles, known as the Fresno County Stream Group. The watershed extends eastward into the Sierra Nevada to an elevation of approximately 4,500 feet above sea level. General site topography is shown in Figure 10. Soils in the basin are predominantly sandy loam and loamy sand with variable permeability as shown in Figure 9.

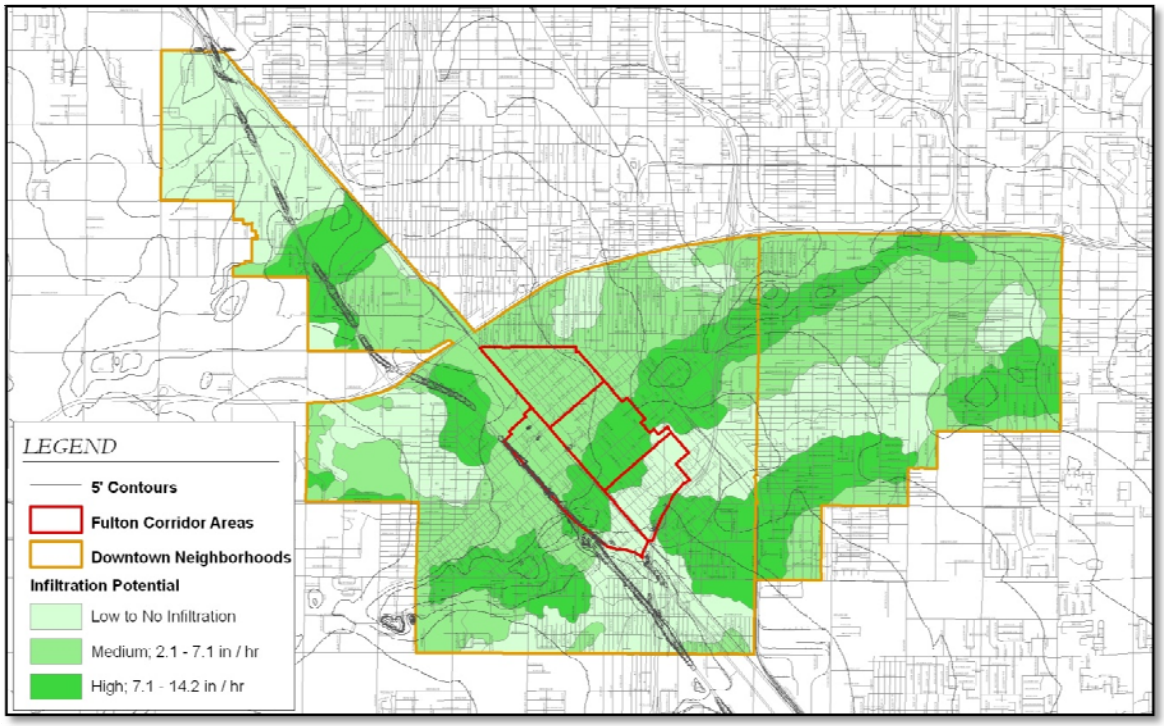

Figure 9. SOILS INFILTRATION POTENTIAL MAP

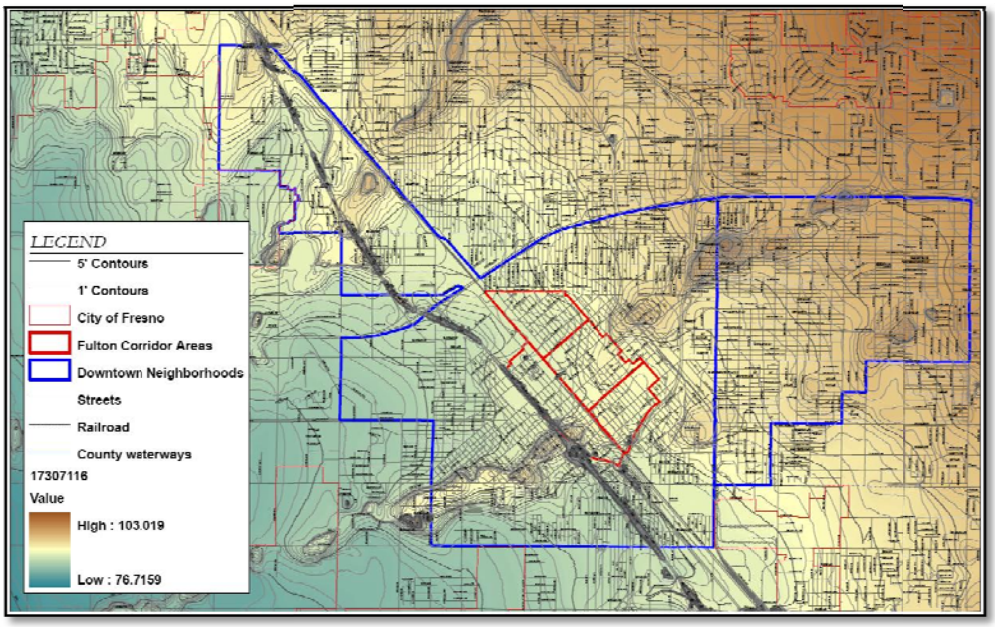

Figure 10. SITE TOPOGRAPHY

Flood Hazard

As shown in Figure 11, large areas of the Downtown Neighborhoods are split between areas outside the floodplain or within the 500 year flood zone. However, there is an area of approximately 100 acres that is considered to be within the 100 year flood zone. This is located at the southern end of the Downtown Neighborhoods along Highway 99 and also to the northeast of the railroad line and south of California Avenue.

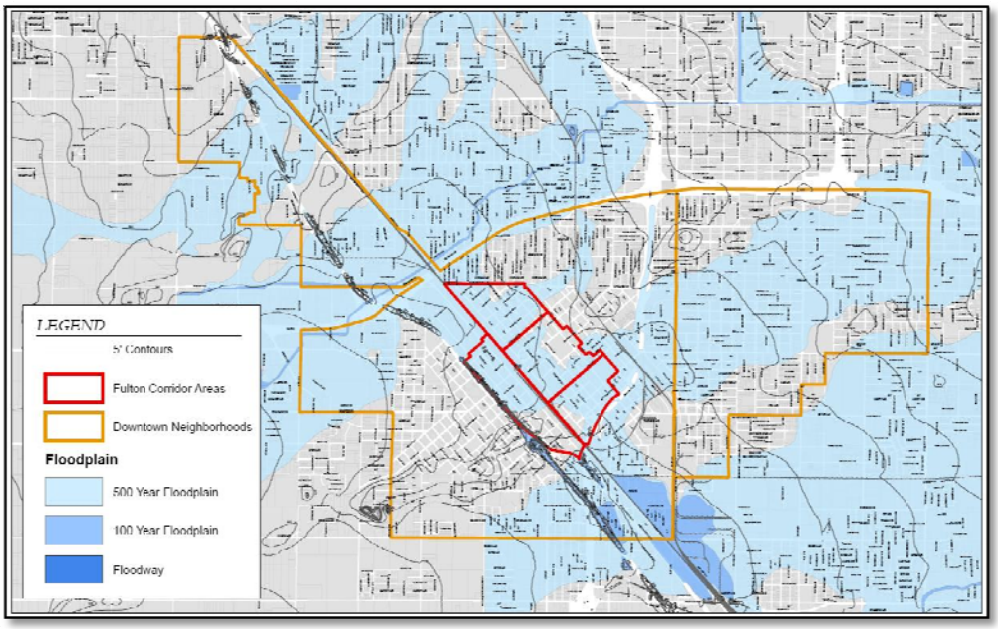

Figure 11. DOWNTOWN NEIGHBORHOODS AREA – FLOOD PLAIN MAP

The southwestern edge of the Fulton Corridor Plan Area currently falls within the 100-year flood zone, and is designated by the Federal Emergency Management Agency (FEMA) as a Special Flood Hazard Area (SFHA). Property owners located in a SFHA with federally backed mortgages are required to purchase flood insurance in accordance with the Federal Insurance Rate Map (FIRM). The remaining Plan Area is mostly located within the secondary 500-year flood zone. Figure 12 shows the extents of these flood zones within Fulton Corridor.

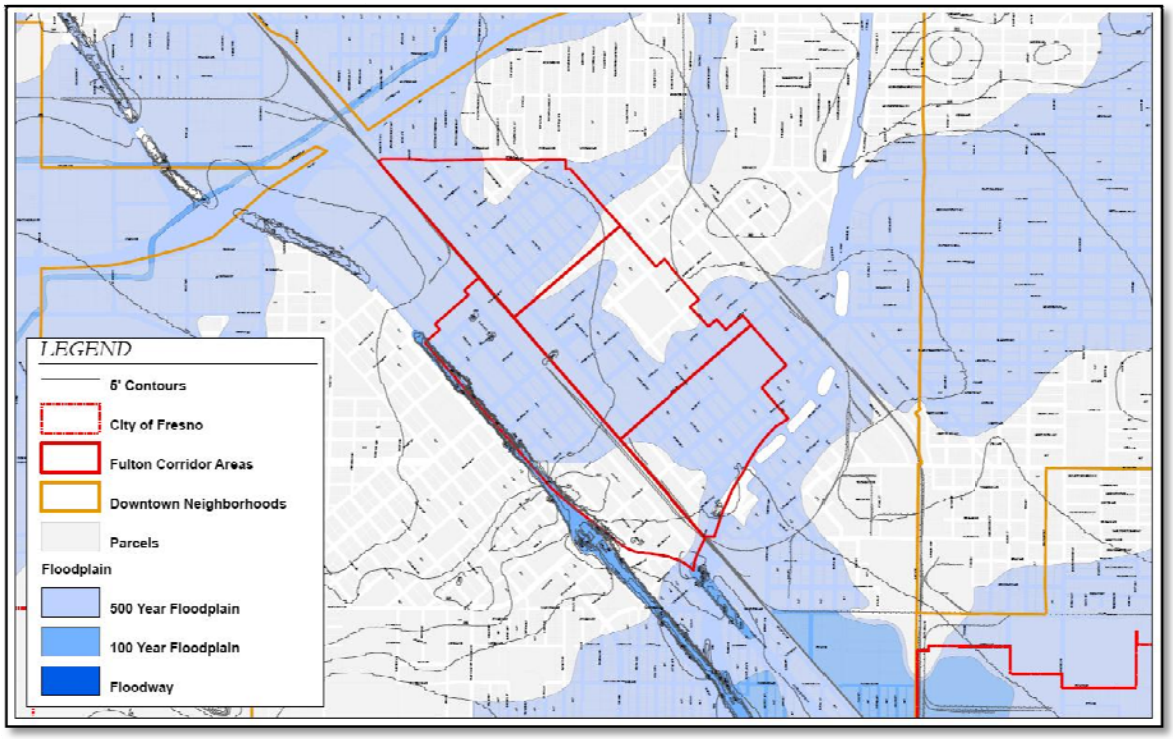

Figure 12. FULTON CORRIDOR PLAN AREA – FLOOD PLAIN MAP

Flood Control

The District's flood control program consists of eight major flood control facilities and related streams and channel features that control the flows from several low-elevation streams collectively referred to as the Fresno County Stream Group. The Stream Group drains a part of the west slope of the Sierra Nevada between the San Joaquin and Kings rivers. The major structural elements of this flood control system include:

- Big Dry Creek Dam and Reservoir
- Fancher Creek Dam and Reservoir
- Pup Creek Detention Basin
- Alluvial Drain Detention Basin
- Redbank Creek Detention Basin
- Redbank Creek Dam and Reservoir
- Fancher Creek Detention Basin
- Big Dry Creek Detention Basin

The District is the local sponsor of the U.S. Army Corps of Engineers' (USACE) Redbank-Fancher Creeks Flood Control Project, which represents the first five facilities listed above. Through its contract with the federal government, the District is responsible for construction cost sharing, land acquisition, operation, and maintenance of these facilities. All elements are completed, except the Fancher Creek and Big Dry Creek Detention Basins, which are currently under construction. Fancher Creek Detention Basin will provide direct benefits to both the District and the Fresno Irrigation District. In addition to and separate from the Federal Redbank-Fancher Creeks Project, the District is currently planning the Dry Creek Extension Basin (Qualls Property). This will be a rural flood control basin located southwest of the City of Fresno, providing storage for floodwaters flowing through Fanning and Dry Creek Canals.

Storm Water Quality Management

In compliance with the federal Clean Water Act and storm water permit regulations, the District and four other local public agencies (County of Fresno, City of Fresno, City of Clovis, and CSU Fresno) developed a storm water quality management program to be implemented in the Fresno-Clovis metropolitan area as a part of the NPDES municipal storm water permit process. The current NPDES permit was recently renewed in 2008.

Local Storm Water Drainage

The District's local storm water drainage system, shown in Figure 13, provides control and disposal of storm water runoff generated by local land uses. The City of Fresno Street Maintenance Division and the County of Fresno Road Maintenance Division manages storm water runoff on streets, sidewalks, and the City's gutter system. The runoff is then collected in drop inlets and conveyed to the District's pipe networks, pump stations, and infiltration basins. Although the District's jurisdiction technically begins inside the inlet and ends at the retention basin or pump station, the City of Fresno currently maintains the pipelines, pump stations and inlets owned by the District on individual work authorizations. The metropolitan portion of the District is divided into local drainage areas of approximately one to two square miles. These drainage areas are identified and established through the on-going revision of the District Storm Drainage and Flood Control Master Plan. Within the drainage areas, the District operates and maintains a complex system of surface conveyances, storm drains, pump stations and retention basins that capture and recharge storm water to the groundwater aquifer. Unlike metro areas in Los Angeles and the San Francisco Bay Area, the City doesn't have major lined channels, or pipelines that outfall to the ocean. The City is also unique in that it retains much of its stormwater in drainage basins within the City sphere throughout the metro area. The system is designed to retain and infiltrate as much runoff as possible, while conveying water from drainage basins to other District facilities, irrigation canals, creeks, and the San Joaquin River.

Underground pipeline projects funded by the American Recovery & Reinvestment Act (ARRA) will be built in areas of Fresno currently lacking a complete storm drain system. Neighborhoods with deficient storm drain systems are subject to increased local flooding, lower property values, and higher insurance costs for homeowners and businesses. These areas have not historically generated sufficient tax revenue to fund the construction of modern drainage facilities.

Portions of the downtown area have experienced localized flooding as evidenced by water damage in streets. To mitigate these flood hazards, storm drain improvements—such as replacing or supplementing existing pipes, adding inlets, or updating pump stations—are needed to facilitate conveyance and detention in these areas. Figure 14 shows where new underground pipelines will be built. The completed systems will route stormwater directly to existing flood control ponding basins. Stormwater basin water recycling systems funded by the ARRA will be installed at five landscaped ponding basins currently reliant on City of Fresno potable water. In most cases these projects require new pumps, piping, screens and filters to convert each basin's irrigation network to the new "dual-source" system. Once operational, these systems will begin saving potable (i.e. drinking) water that can be used elsewhere in the City for uses that actually require drinking-quality water. Landscaping in the five basins will rely much of the year on rainwater collected in the bottom of the basin. The District has adopted an ambitious schedule that foresees the completion of all ARRA work before the end of calendar year 2010, a full year ahead of the official schedule for this project.

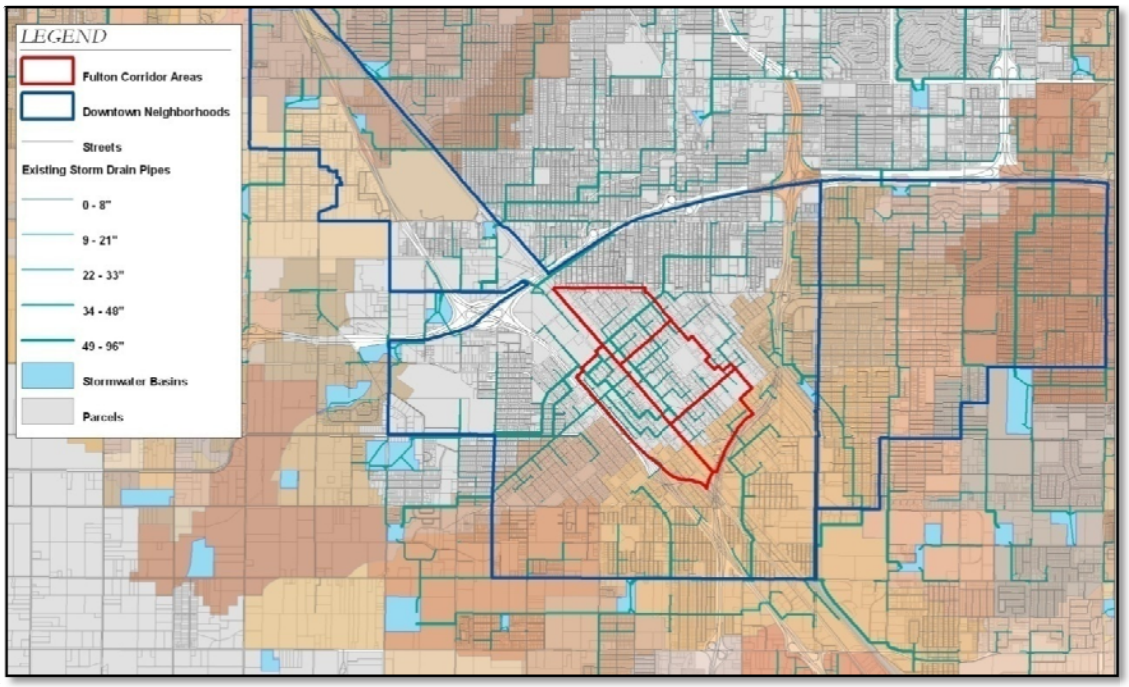

Figure 13. EXISTING STORM DRAIN SYSTEM AND WATERSHEDS

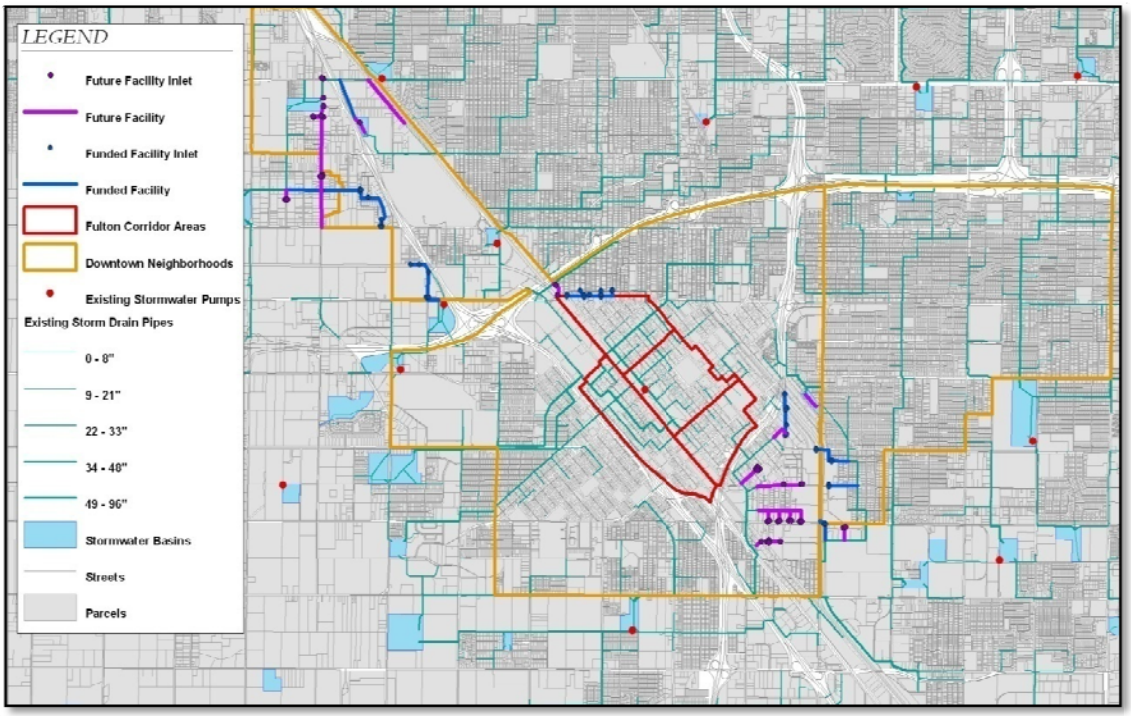

Figure 14. EXISTING STORM DRAIN SYSTEM AND PLANNED IMPROVEMENTS

FULTON MALL

A primary focus of the Plan Area is Fulton Mall, a six block long outdoor pedestrian mall that anchors Fresno's Central Business District. Fulton Mall stretches from Tuolumne Street at its northern end, to Inyo Street at its southern end

The existing water distribution system in this corridor consists of mostly 10" and 12" pipes, less than half of which are more than 50 years old. Per the 2009 West Yost and Associates analysis, the existing water mains generally provide the required 3,500 gpm fire flow, with the exception of the 8" main in Homerun Alley between Fresno Street and Mariposa Mall. However, this assessment was only valid for population and densification projections per the 2025 General Plan, levels which are anticipated to be surpassed by the current Fulton Corridor Specific Plan, Downtown Neighborhoods Community Plan, and 2035 General Plan Update. Further modeling and analysis of the City's water infrastructure within Fulton Corridor is thus needed to accurately account for additional development projected by ongoing planning efforts, in order to achieve an order of redundancy in the water supply for buildout conditions. Additionally, any development at a Program Level would require the implementation of the MWRMP, else the City will be in violation of the Master Environmental Impact Report.

Existing sewer pipes in Fulton Mall are 6" in diameter or larger. Several pipes, including trunk lines greater than 27" identified as Large Diameter Rehabilitation projects, are more than 50 years old.

Fulton Mall lies entirely outside the 100 year flood plain and the existing storm drainage pipes, ranging from 14" to 72", generally provide sufficient drainage capacity.

REFERENCES

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Martin, Lon M., *Update On Water Infrastructure For the Central Area (Downtown)*, 2009.

West Yost Associates, *City of Fresno Urban Water Management Plan*, 2008.

West Yost Associates, *Technical Memorandum: Hydraulic Evaluation of the Downtown Central Area*, 2009.

APPENDIX A

REPORT:

Date:	May 27	
Report	**City of Fresno**	
Project Name:	09-890 Fulton Corridor Specific Plan	
Recipient:		
Copies to:		
Prepared by:	Michael Amodeo, Eric Zickler	

I. SUMMARY OF PURPOSE:

Sherwood Design Engineers has prepared this memorandum to summarize and evaluate the existing policies currently in place and planned for the community Plan Area within the City of Fresno. The policies are evaluated to identify which policies contribute positively or negatively to the sustainable use of resources within the plan area. Additionally, recommendations are made for policies that could be improved upon to increase sustainable measures within the community Plan Area.

II. ANALYSIS:

This analysis has utilized several documents to create a comprehensive summary of the water use policies within the community Plan Area. The documents referenced are listed below:

2025 Fresno General Plan (GP), February 2002
City of Fresno Urban Water Management Plan (UWMP), August 2008
City of Fresno Recycled Water Master Plan and Ordinance (RWMP), May 2010
Municipal Code of Fresno, California (MC)

A. DISCUSSION OF FOCUS:

This document primarily studies the impact on water use and conservation, stormwater systems, energy, and wastewater utilities with the community plan area.

B. POLICIES THAT PROMOTE SUSTAINABILITY

- CUWCC BMP 01 (UWMP): Water Survey Programs for Single Family and Multi-Family Residential Customers
- CUWCC BMP 02 (UWMP): Residential Plumbing Retrofit
- CUWCC BMP 05 (UWMP): Large Landscape Conservation Programs and Initiatives
- Water Conserving Landscape Requirements in Section 6-522 of municipal code.CUWCC BMP 06 (UWMP): High Efficiency Washing Machine Rebate Programs
- CUWCC BMP 07 (UWMP): Public Information Programs

- CUWCC BMP 08 (UWMP): School Education Programs
- CUWCC BMP 12 (UWMP): Water Conservation Coordinator
  - City has full-time Water Conservation Supervisor and eight permanent support staff
- CUWCC BMP 13 (UWMP): Water Waste Prohibitions
  - Section 6-520 Wastage of Water of city municipal code
- CUWCC BMP 14 (UWMP): Residential Ultra-Low Flush Toilet Replacement Programs
- G-4-a, G-4-b (GP): Utilize surface water to recharge aquifer
- G-4-d (GP): Explore use of treated and reclaimed wastewater for irrigation.
- G-4-g (GP): Maintain a comprehensive conservation program reducing per capita water usage in the city.
- G-9-c (GP): Through its regulation of land use planning and development, the city will provide for energy conservation.
- Recycled Water Ordinance (Planned, RWMP): Requirement for existing and new water customers to use recycled water in locations where recycled water is available and the use of non-potable water is approved.

C. POLICIES THAT COULD BE EXPANDED UPON

- CUWCC BMP 03 (UWMP): System Water Audits
  - Water system evaluation will be improved once the system is entirely metered, yielding more data to evaluate. Advancing the schedule for metering implementation would allow a system model to be created sooner as well.
- CUWCC BMP 04 (UWMP): Metering with Commodity Rates for all New Connections and Retrofit of Existing Connections
  - The City is currently working toward metering all customers before March of 2013 based on Assembly Bill 514. The original schedule for these meter installations required 45,000 meters to be installed by 2009, and 20,000 meters to be installed each of the next three years, completing the retrofit at the end of 2012. Advancing this schedule will allow for immediate water savings and implementing an aggressive tiered-rate program would start to change the public's relationship with water use. It should be noted that Fresno has some of the highest water use per capita in the state and the lowest rates.
- CUWCC BMP 09 (UWMP): Conservation Programs for Commercial, Industrial and Institutional Accounts
  - According to the UWMP, "The City does not currently have qualified staff for this program and cannot respond to requests." Commercial, industrial, and institutions are the largest individual users of water. Improving staff resources to address conservation among these users can quickly create large reductions in city water use. Another option would be to incentivize these users to install the necessary infrastructure to connect to the City's reclaimed water system once it comes online.
- CUWCC BMP 11 (UWMP): Conservation Pricing
  - As the city installs meters throughout the city, conservation pricing can be enabled. This adds to the advantages of implementing the meter installations sooner.
- G-2-a (GP): Support multi-agency regional water resource planning.
  - Additional definition and programs to coordinate between agencies will produce more specific gains in water conservation.

- G-2-b (GP): Ensure cost-effective use of water resources and continued availability of good-quality groundwater and surface water supplies
  - Sustainable measures for alternative water sources can supplement groundwater and surface water, reducing reliance on these traditional sources.
- G-2-c (GP): Completion of a Groundwater Management Plan
  - Management of the groundwater is essential, but additional measures should be taken to create a comprehensive water use strategy for the community plan area.
- G-4-f (GP): Appropriate conditions of approval to ensure adequate future potable water supply for projects seeking approval.
  - Enforce reduced usage rates for projects coming online and previously approved projects.
- G-9-a (GP): The city shall continue its leadership role in energy conservation through its own facilities and operations.
  - The city can increase its leadership by working in tandem with PG&E to offer rebate programs similar to its water rebate programs for efficient appliances. The city can also work to educate residents and businesses about conservation, much like its programs for water conservation.
- Sec 6-714 (MC): Requirement to prevent, control, and reduce stormwater pollutants
  - This allows the city to draft requirements for stormwater Best Management Practices (BMPs), but the municipal code does not contain these requirements.

D. POLICIES THAT DETRACT FROM SUSTAINABILITY

- G-4-a (GP): Utilize surface water for landscape irrigation
  - Landscape irrigation is an excellent use for alternative water sources, such as recycled water or rainwater. This is more in line with Policy G-4-d.
- Sec 6-529-b,d (MC): Consumers receiving metered water service are allowed to receive unmetered service if the city approves the request.
  - This is contrary to AB 514, and will have to be removed from the municipal code in 2013. Until that time, the city should not approve such requests.
- Sec 13-208-e (MC): Street improvements require large amounts of asphalt, curbs, gutters, and concrete sidewalks.
  - Requiring strict conformance to a traditional street archetype restricts the use of stormwater BMPs such as bulb-outs and permeable pavement. Additionally, large continuous areas of hardscape contribute to the heat island effect.
- Sec 13-221 All water conveyances must be covered and enclosed.
  - Public water features utilizing stormwater allow for education on the subject of stormwater management, as this keeps stormwater in the consciousness of the residents. This code seemingly restricts the potential for artificial streams in public parks as well as creek daylighting.

III. Conclusion / Opportunities

The current policies for the city of Fresno are set up for major gains in water conservation and alternative uses in the next 15 years. Although the city currently has a high per capita water use, the passage of Assembly Bill 514 requiring metering is allowing the city to begin to make strides toward water conservation. The tracking of water use throughout the city and the implementation of quantity charges should provide for significant reductions in water use. The city can also achieve other reductions in water use by dedicating staff resources to working with non-residential users to assess their water use. The city should also be tracking to stay current with the recent landscape

policies put into effect by the state's Department of Water Resources in their Model Water Efficient Landscape Ordinance.

Alternative water sources are also being explored by the city in the form of the recycled water master plan. Recycled water is a valuable source of water, and the planning and permitting of these facilities should be expedited. Additionally, new construction should be required to include piping for recycled water use so that it can be turned on once the recycled water plant is in operation. The dedication of recycled water for irrigation uses will also provide significant relief to the city's water sources upon approval and construction.

The city has an opportunity to take a more active role in energy conservation and even generation, as the General Plan focuses solely on conservation within the city's own facilities rather than mirroring the community programs enacted for water conservation.

Policy ID	**Location**	**Year**	**Effect on Sustainability**
CUWCC BMP 01	UWMP	2008	Promote
CUWCC BMP 02	UWMP	2008	Promote
CUWCC BMP 03	UWMP	2008	Expansion Recommended
CUWCC BMP 04	UWMP	2008	Expansion Recommended
CUWCC BMP 05	UWMP	2008	Promote
CUWCC BMP 06	UWMP	2008	Promote
CUWCC BMP 07	UWMP	2008	Promote
CUWCC BMP 08	UWMP	2008	Promote
CUWCC BMP 09	UWMP	2008	Expansion Recommended
CUWCC BMP 11	UWMP	2008	Expansion Recommended
CUWCC BMP 12	UWMP	2008	Promote
CUWCC BMP 13	UWMP	2008	Promote
CUWCC BMP 14	UWMP	2008	Promote
G-2-a	GP	2002	Expansion Recommended
G-2-b	GP	2002	Expansion Recommended
G-2-c	GP	2002	Expansion Recommended
G-4-a	GP	2002	Promote / Detract
G-4-b	GP	2002	Promote
G-4-d	GP	2002	Promote
G-4-f	GP	2002	Expansion Recommended

Policy ID	Location	Year	Effect on Sustainability
G-4-g	GP	2002	Promote
G-9-a	GP	2002	Expansion Recommended
G-9-c	GP	2002	Promote
Recycled Water Ordinance	RWMP	2010	Promote
6-529 b,d	MC	2010	Detract
6-714	MC	2010	Expansion Recommended
13-208 e	MC	2010	Detract
13-221	MC	2010	Detract

APPENDIX B

Comment Tracking Response Sheets

Figure 6 (Full-Size)

EXISTING WATER SYSTEM AND PLANNED IMPROVEMENTS