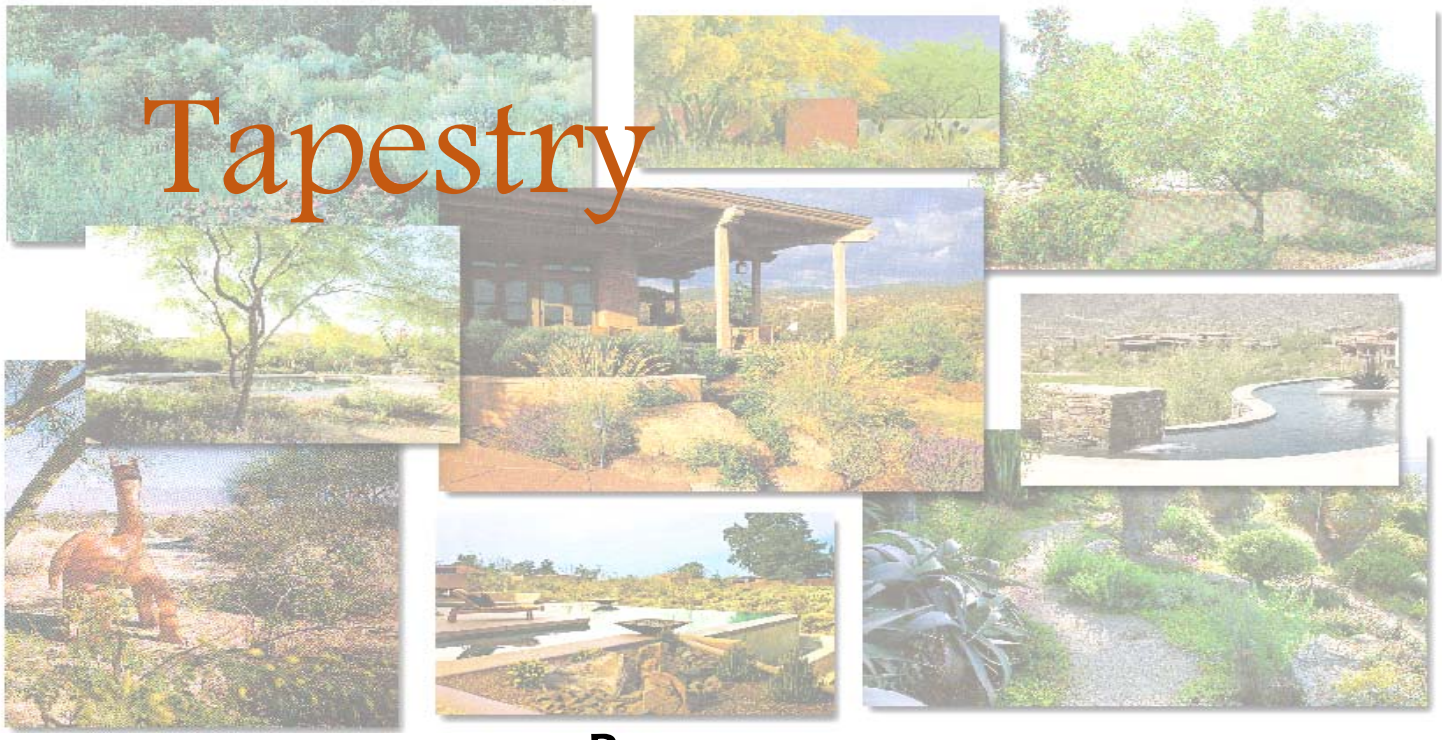


PRELIMINARY

# RECYCLED WATER STUDY

# Tentative Tract Map No. 18955

## CITY OF HESPERIA

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**Date:** February 21, 2014

# Tapestry

# PHASE 1

## Onsite Recycled Water Facilities

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# 1.0 Recycled Water WWRP Supply

The Tapestry development's recycled water supply source will be provided by a new Wastewater Recycling Plant (WWRP) located onsite. The proposed WWRP will treat the wastewater generated by the Tapestry project, and be located in the north east portion of the project. A 13-acre site is provided for this WWRP. To reduce the land requirements and footprint of the plant, the plant is proposed to be a membrane filtration (MBR) plant.

The proposed capacity of the WWRP will be based on the wastewater generated by the project, which is estimated to be 4.3 MGD. However, the WWRP will need to be constructed in phases as the development of the project progresses. It anticipated that the WWRP inlet and outlet facilities, pumping facilities, and headworks will be initially sized for ultimate capacity. The process equipment will be installed in phases, or trains, as wastewater flows increase. Solids handling treatment processes will also be required by the WWRP, in accordance with the Hesperia Recycled Water Master Plan.

The WWRP will treat the wastewater collected to California Code of Regulations, Title 22, disinfected tertiary recycled water standards. The agencies responsible for regulating and permitting the WWRP include CDH, SWRCB, and the RWQCB. The CDH is the primary state agency responsible for public health, bu the SWRCB and the RWQCB are the agencies charged with protection, coordination, and control of water quality. The CDH interprets the laws dictated by the California Code of Regulations applicable to recycling and makes recommendations to the RWQCB, which is overseen by the SWRCB. The RWQCB issues the final permit for water reclamation.

Recycled water quality, permitting requirements, and treatment plant processes and design are not addressed by this master plan document. This Recycled Water Facilities Master Plan is intended to estimate proposed recycled water demands and conveyance infrastructure required to serve the proposed development recycled water supply.

Facilities that will be necessary as part of the WWRP to supply the project with the treated effluent will include an effluent storage equalization basin, and effluent pump stations to the project's Zone 2 and Zone 3A distribution systems. Sizing of these facilities is discussed in the following sections.

# 2.0 Phase 1 Land Uses and Recycled Water Demands

## 2.1 Phase 1 Land Uses and Recycled Water Demand Factors

The proposed recycled water system demands have been estimated for the proposed Phase 1 irrigable land uses within the development. Recycled water demand projections assume that the recycled water will be available for irrigation of all common landscape areas, residential yard irrigation, medians, irrigated slopes, parks, and schools. No recycled water is assumed for residential exterior irration.

**Table 2-1**
**Phase 1 Land Uses and Recycled Water Demand Duty Factors**

| Land Use | Area (acres) | Irrigation Application Rate (AFY/ac) | Total Percent of Land Use Irrigated |
|---|---|---|---|
| Schools | 15 | 3.6 | 40% |
| Parks | 75 | 3.6 | 100% |
| Arterial Median/Pkwy Landscape | 10 | 3.6 | 100% |
| Irrigated Slopes | 9 | 3.6 | 100% |
| WWRP | 13 | 3.6 | 20% |

SF = square feet

AFY = acre-feet per year

## 2.1 Phase 1 Summary of Recycled Water Demands

The recycled water demands for each irrigation land use have been calculated using the criteria and water duty factors as discussed above. Based on these factors, it is estimated that the Tapestry Phase 1 development will use approximately 360 acre-feet of recycled water annually on average. Table 2-2 below provides detailed summary of the demands by each irrigation land use.

**Table 2-2**
**Summary of Annual Average Recycled Water Demands by Land Use**

| Land Use | Acres | Average Annual Demand (AFY) | Average Annual Demand (MGD) |
|---|---|---|---|
| Schools | 15 | 55 | 0.05 |
| Parks | 75 | 230 | 0.20 |
| Arterial Median/Pkwy Landscape | 10 | 35 | 0.03 |
| Irrigated Slopes | 9 | 31 | 0.03 |
| WWRP | 13 | 9 | 0.01 |
| | **Total** | **360** | **0.32** |

AFY = acre-feet per year, average annual demand
MGD = million gallons per day, average annual demand

# 3.0 Phase 1 Recycled Water System Pressure Zone

Due to the terrain of the project area, the ultimate project build-out will be required to distribute the recycled water supply through four (4) pressure zones. Each pressure zone, including the storage facilities, will match those of the domestic water system for purposes of land use efficiency and operational benefits of the system. The Phase 1 distribution will require only two pressure zones.

Table 3-1 is provided to list the proposed pressure zones' hydraulic grades and the service elevations anticipated along with the estimated static pressures.

**Table 3-1**
**Phase 1 Recycled Water Pressure Zone and Static Pressures**

| Pressure Zone | HGL | Ground Elevation Service Range (ft) | Minimum Static Pressure (psi) | Maximum Static Pressure (psi) |
|---|---|---|---|---|
| Zone 2 | 3402 | 3130 - 3265 | 59 | 118 |
| Zone 3A | 3528 | 3210 – 3380 | 64 | 138 |

## 3.1 Recycled Water Peaking Factors

In order to adequately size the infrastructure required for the project, the average annual demands presented in Table 2-1 need to be estimated for maximum day demand conditions and for peak hour demand conditions. To estimate these demand conditions, the average annual demands are multiplied by a peak factor. The peaking factors used by the City in their current Recycled Water Master Plan were used for this study. Table 3-2 shows the peaking factors utilized.

**Table 3-2**
**Domestic Water Demand Peaking Factors**

| Demand Condition | Peak Factor |
|---|---|
| Maximum Day | 1.90 x Average Demands |
| Peak Hour[1] | 3.80 x Average Demands |

[1] As determined in the City's Recycled Water Master Plan, the peak hour factor of 3.8 assumes a 12-hour irrigation period for highway medians, schools, parks, new residential developments, and commercial uses.

## 3.2 Phase 1 Recycled Water Demands by Pressure Zone

Using the projected recycled water demands shown in Table 2-2 and the pressure zones identified in Table 3-1 the projected recycled water demands are estimated for pressure zone. Table 3-3 provides a summary of the proposed demands by pressure zone and for each demand condition.

**Table 3-3**
**Phase 1 Recycled Water Demands by Pressure Zones**

| Pressure Zone | Average Annual Demands (AFY) | Average Day Demands (MGD) | Maximum Day Demands (MGD) | Peak Hour Demands (gpm) |
|---|---|---|---|---|
| Zone 2 | 18 | 0.02 | 0.03 | 42 |
| Zone 3A | 342 | 0.31 | 0.59 | 842 |
| **Total** | **360** | **0.33** | **0.62** | **884** |

# 4.0 Phase 1 Recycled Water System Facilities

The proposed onsite recycled water system required to service the project will consist of WWRP effluent supply pumping facilities, several storage tanks, booster pump stations, and pressure regulating stations for the four pressure zones required. The following discussion summarizes the proposed sizing and design criteria for each of the facilities identified.

## 4.1 WWRP Effluent Supply Facilities

Effluent supply water from the WWRP will be stored at the WWRP facility consisting of an effluent equalization basin. This equalization basin will be used to equalize the effluent flow from the WWRP to the Zone 3A storage tank and demands. For Phase 1 it is assumed that the WWRP effluent equalization basin will be sized for 30% of the daily effluent volume, or 0.1 MG.

Additionally, the effluent from the WWRP will be pumped to the recycled water distribution system via recycled water pump station to Zone 3A. The WWRP Effluent Zone 3A pump station will be used to meet Zone 3A demands. The following table shows the WWRP Effluent pump station hydraulic parameters.

**Table 4-1**
**Phase 1 WWRP Effluent Pump Stations**

| Pump Station | Approximate Capacity (gpm) | Approximate No. of Pumps | Approximate Station Horsepower (Hp) |
|---|---|---|---|
| WWRP Zone 3A | 1,000 | 3 | 300 |

## 4.2 Phase 1 Storage Tanks

One Phase 1 onsite storage tank is required for operational equalization of the distribution system. Although, storage is not required for fire protection or emergency conditions as with the domestic water system, storage is required for operational purposes. As discussed in the City's Recycled Water Master Plan, storage for the recycled water system is based on a percentage of maximum day demands. This study assumes that the storage tank sizing is based on one maximum day demands for the tributary service area. Table 4-2 is provided to show the storage requirements for the storage tank. It is assumed that the ultimate capacity of this storage tank will be constructed for Phase 1.

**Table 4-2**
**Recycled Water Storage Requirements**

| Storage Tank | Tank Service Area Maximum Day Demands (MGD) | Total Storage Requirement (MG) |
|---|---|---|
| Zone 3A | 1.53 | 1.53 |

Table 4-3 is provided to show the tank elevations and sizes assumed. The parameters shown in the table assumes each tank will be an above ground steel tank.

**Table 4-3**
**Phase 1 Storage Tank Sizes and Elevations**

| Storage Tank | Nominal Volume (MG) | High Water Level (ft) | Bottom Elevation (ft) | Tank Water Height (ft) | Tank Diameter (ft) |
|---|---|---|---|---|---|
| Zone 3A | 1.6 | 3528 | 3493 | 35 | 90 |

## 4.2 Phase 1 Pressure Reducing Stations

Pressure reducing stations are proposed for areas and within pressure zones where the elevations fall below the maximum service elevations recommended. One pressure reducing station is required as shown in Table 4-5.

**Table 4-5**
**Phase 1 Pressure Reducing Stations**

| Pressure Reducing Station | Service Zone | Approx. Ground Elevation (ft) | Pressure Setting (psi) | Flow Capacity (gpm) |
|---|---|---|---|---|
| 1 | Zone 3A to Zone 2 | 3222 | 45 | 200 |

## 4.4 Pipeline Facilities

A hydraulic model analysis was performed to evaluate the proposed distribution system to determine approximate pipeline diameters required for the project. Pipeline analysis and design criteria as stated in the City's current Recycled Water Master Plan were utilized. The maximum velocity for a pipeline was assumed to be 5 fps, with a minimum velocity of 1 fps during peak demand periods for adequate flushing of the line.

Minimum pressures desired to be 60 psi to allow for irrigation system operation. However, due to the terrain, there are a few areas where pressures do not meet this minimum and are below 50 psi. For these areas, it will be necessary for the irrigation system to include an irrigation pump at the meter as necessary to provide the pressure requirement for irrigation system.

The model was analyzed for peak hour demands, steady-state scenario. The model analysis assumes that for peak hour conditions, supply is provided by the WWRP effluent pump stations as well as the seasonal storage effluent pump station.

Based on the analysis results, the proposed pipeline diameters range from 4-inch to 16-inch diameter pipes. Pipelines are assumed to be as small as 4-inch and 6-inch diameters as the system reaches a small number of meters and demands. Sizing pipes too large with little flow may result in water quality concerns. Large diameter pipes up to 16-inch diameter are necessary between pump stations and storage tanks.

# 5.0 Phase 1 Seasonal Storage Analysis

It is assumed for this study, that the excess effluent from WWRP is to be stored in a seasonal storage reservoir to be located near the WWRP so that the excess effluent during the wet winter months can be used in the dry summer months. A seasonal storage analysis is necessary due to the nature of the recycled water supply and the recycled water demands. Throughout the year, the recycled water supply from the WWRP is considered to be fairly consistent all year. However, the recycled water demands are not consistent all year and vary significantly between the winter wet season and the dry summer season.

## 5.1 Phase 1 Monthly Demands and Supply

Using the criteria and assumptions used in the City's Recycled Water Master Plan, the following table shows the recycled water demands based on seasonal or monthly demand analysis.

**Table 5-1**
**Phase 1 Monthly Recycled Water Demands**

| Month | Evapo-Transpiration (in) | Rainfall (in) | Net Irrigation Req'ment (in) | Percent of Annual | Monthly Recycled Water Demands (AF) |
|---|---|---|---|---|---|
| January | 2.02 | 1.02 | 1.35 | 2% | 6 |
| February | 2.61 | 1.04 | 2.12 | 3% | 9 |
| March | 4.55 | 0.83 | 5.03 | 6% | 22 |
| April | 6.19 | 0.34 | 7.91 | 10% | 35 |
| May | 7.3 | 0.16 | 9.66 | 12% | 42 |
| June | 8.85 | 0.05 | 11.9 | 15% | 52 |
| July | 9.77 | 0.15 | 13.01 | 16% | 57 |
| August | 8.99 | 0.19 | 11.9 | 15% | 53 |
| September | 6.52 | 0.28 | 8.44 | 10% | 37 |
| October | 4.66 | 0.3 | 5.9 | 7% | 26 |
| November | 2.68 | 0.51 | 2.94 | 4% | 13 |
| December | 2.05 | 0.73 | 1.79 | 2% | 8 |
| **Total** | **66.19** | **5.6** | **81.95** | **100%** | **360** |

Based on the monthly demands as shown in Table 5-1 above monthly demands versus supply analysis can be performed. Table 5-2 is provided to show the difference between supply and demand for each month.

**Table 5-2**
**Monthly Recycled Water Demands Versus Supply**

| Month | Average Monthly WWRP Effluent Supply[1] (AF) | Monthly Recycled Water Demands (AF) | Excess WWRP Effluent Supply (AF) | Supply Deficit (AF) |
|---|---|---|---|---|
| January | 43 | 6 | 38 | - |
| February | 43 | 9 | 34 | - |
| March | 43 | 22 | 21 | |
| April | 43 | 35 | 9 | |
| May | 43 | 42 | 1 | |
| June | 43 | 52 | - | 9 |
| July | 43 | 57 | - | 14 |
| August | 43 | 53 | - | 10 |
| September | 43 | 37 | 6 | |
| October | 43 | 26 | 18 | |
| November | 43 | 13 | 31 | - |
| December | 43 | 8 | 36 | - |
| **Total** | **521** | **360** | **193** | **32** |

[1] Assumes Effluent Supply to the Recycled Water System is 90% of the total wastewater flows to the WWRP.

## 5.2 Phase 1 Seasonal Storage Requirement

The seasonal storage requirement is based on the total supply deficit as shown in Table 5-2. The total seasonal storage requirement to meet recycled water demands in the dry summer months 32 AFY, which is less than the total excess WWRP effluent supply available. There will be annual excess of WWRP effluent supply of approximately 193 AFY during normal years. This annual excess will need to be discharge offsite.

## 5.3 Phase 1 Seasonal Storage Facilities

The total Phase 1 seasonal storage requirement is 32 AFY. This is assumed to be stored in an open reservoir on the site. The actual location and dimensions of the seasonal storage reservoir will need to

be determined during the design stages of the project. For purposes of this study, it is assumed that the seasonal storage reservoir is to be located in the phase 2 area of the development near the WWRP.

Other considerations for the seasonal storage reservoir might be water quality facilities to maintain proper water quality and limit algae growth of the reservoir. However, this is beyond the scope of this study and will need to be addressed during the design of the reservoir.

### 5.3.1 Seasonal Storage Fill Operations

During the months where there is excess WWRP supply, the recycled water seasonal storage will be in fill mode. Fill mode operations assume that the supply from WWRP will be pumped by a WWRP Effluent Pump Station to the seasonal storage reservoir from the Zone 3A distribution system.

Inlet facilities to the seasonal storage reservoir will consist of regulating valve facilities to control the pressure and flow into the reservoir. Controls will be provided to open or close the inlet valve based on reservoir height. Additionally, inlet infrastructure will be closed when the reservoir is drain mode to meet demand as discussed below.

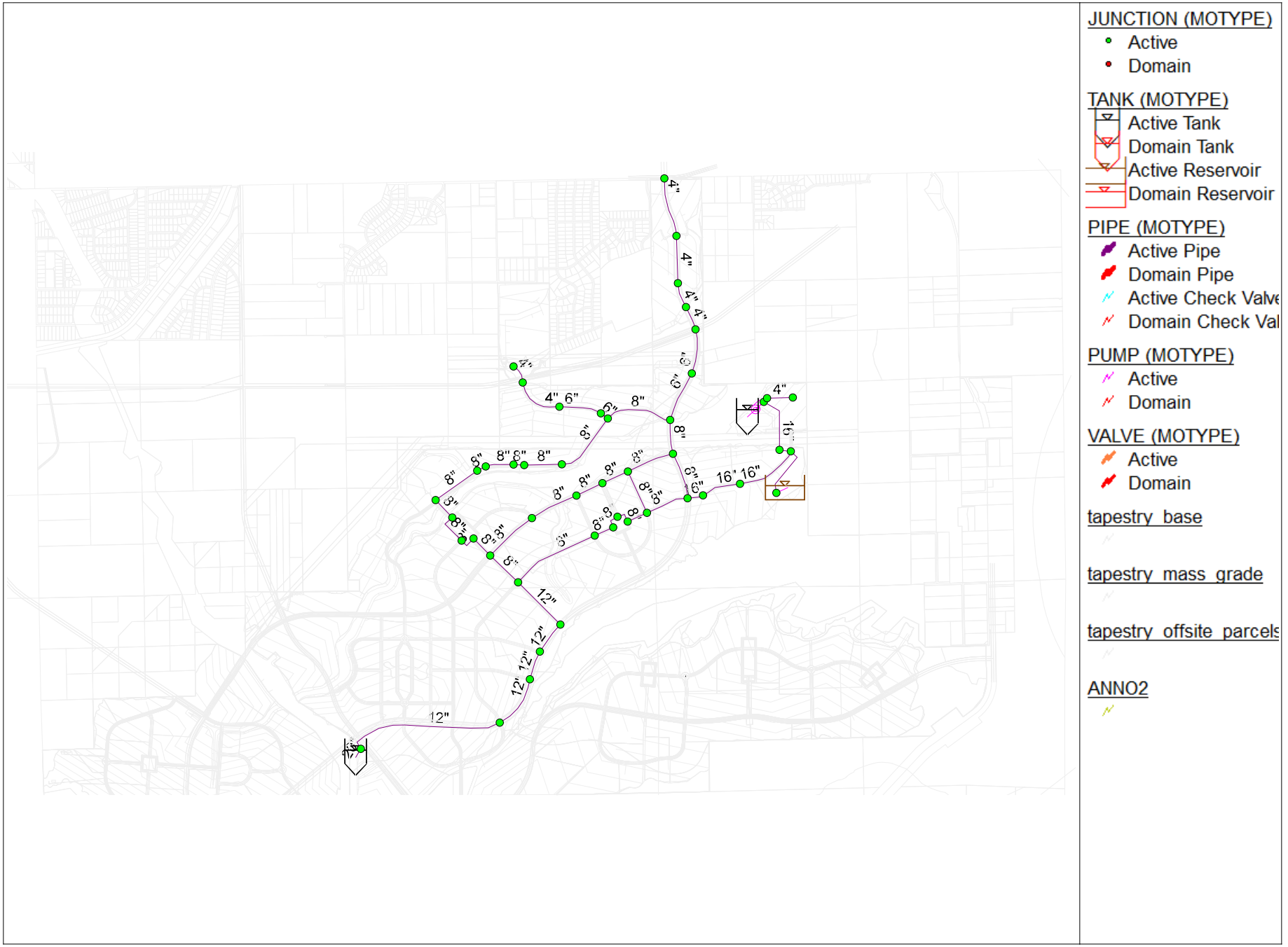
### 5.3.2 Seasonal Storage Drain Operations

During the dry summer months, when there is a shortage in WWRP supply, the recycled water stored in the seasonal storage reservoir will be pumped to Zone 3A to supplement the WWRP Effluent Zone 3A pump station. The following table shows the hydraulic parameters for seasonal storage Zone 3A pump station.

**Table 5-3**
**Seasonal Storage Zone 4 Pump Station**

| Pump Station | Approximate Capacity (gpm) | Approximate No. of Pumps | Approximate Station Horsepower (Hp) |
|---|---|---|---|
| Seasonal Storage Zone 3A | 500 | 3 | 300 |

Other facilities that will be required at the Seasonal Storage Zone 3A pump station will most likely include a strainer or filtration facility and a disinfection system.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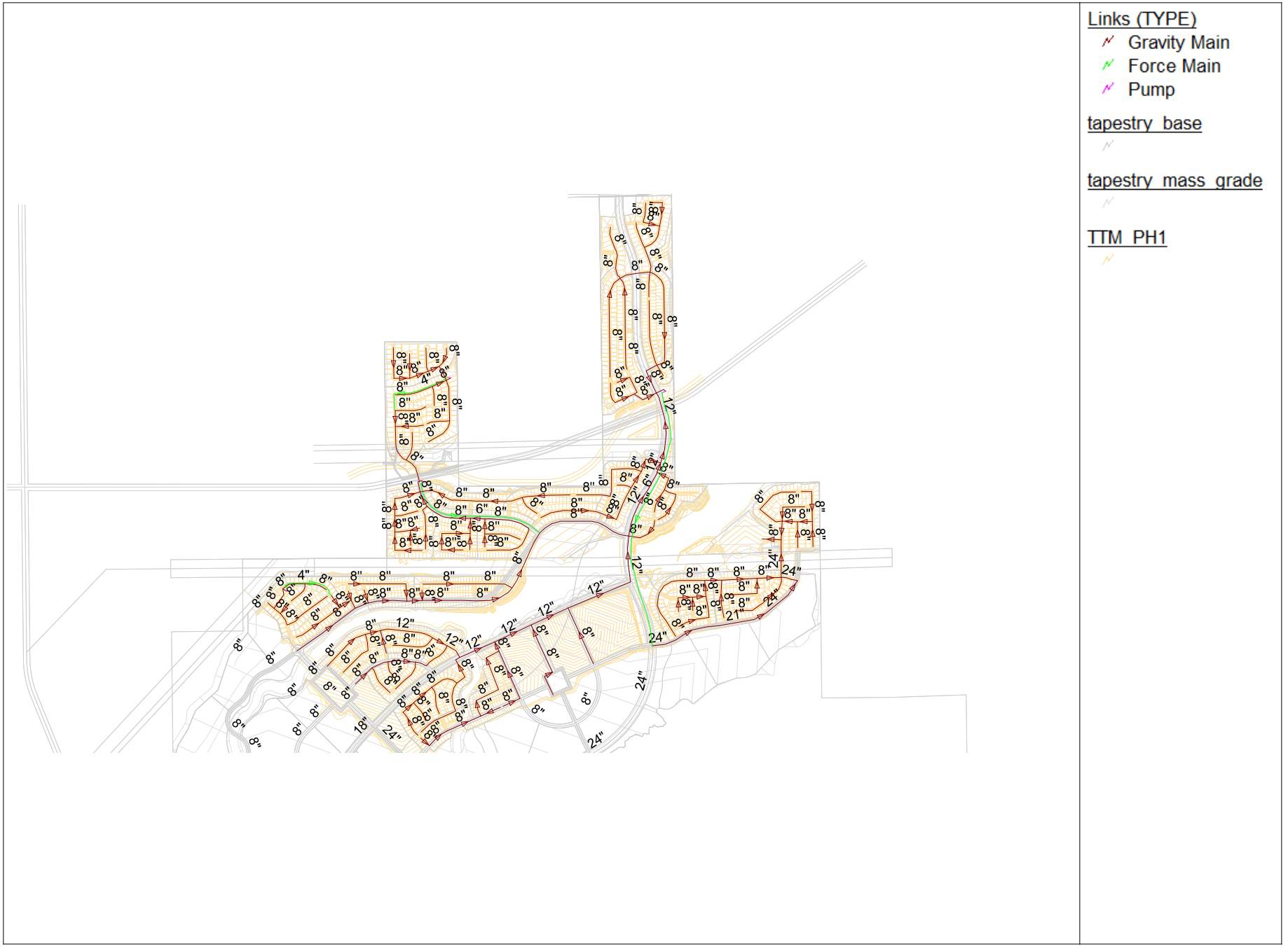
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