

Tapestry

**PRELIMINARY
WASTEWATER CAPACITY STUDY**

Tentative Tract Map No. 18955

CITY OF HESPERIA

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Tapestry

PHASE 1

Onsite Wastewater Collection System Facilities



INFORMATION FOR THE READER

Subsequent to preparation of this technical study for the Tapestry Specific Plan, there have been changes to the Project description that have resulted in a reduction of the number of units proposed. The northern portions of the Specific Plan area within Phase 1 were re-lotted to increase the minimum density, changing the overall number of units proposed from 19,398 to 19,311. The reduction in units would not result in a new or increased significant effect on the environment relative to the analysis contained in this technical study, nor would it change the conclusions with regard to the level of significance of impacts. Therefore, the original analysis of 19,398 units is considered a conservative analysis and has not been updated to reflect the current Project description which proposes a reduction to 19,311 units.

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1.0 Wastewater Collection System

The Tapestry development’s wastewater will be collected by the City of Hesperia through a collection of sewer gravity mains, lift stations, and force mains. The wastewater collected will be conveyed to a single onsite wastewater recycling treatment plant (WWRP).

Wastewater treatment processes, solids handling facilities, and other permitting requirements are not addressed by this master plan document. This Wastewater Collection System Facilities Master Plan is intended to estimate proposed wastewater flows and identify the collection system mains and lift stations.

2.0 Land Uses and Wastewater Flows

2.1 Phase 1 Land Uses and Wastewater Generation Factors

The proposed wastewater flows have been estimated for the proposed land uses within the development. Wastewater duty factors were investigated for each use in estimating the demands, and listed in the table below.

**Table 2-1
Phase 1 Land Uses and Wastewater Generation Duty Factors**

Land Use	Area (acres)	Dwelling Units	Per Capita Wastewater Generation	Persons per Unit	Generation Duty Factor
Low Density Residential	170	516	70 gpcpd	3.3	231 gpd/DU
Low Medium Density Res.	329	1,587	70 gpcpd	3.3	231 gpd/DU
Medium Density Residential	22	220	70 gpcpd	2.7	189 gpd/DU
WWTP	13	-	-	-	-
Schools	15	-	-	-	280 gpd/acre
Parks	75	-	-	-	-
Total	624	2,233			

gpd = gallons per day, average annual demand
 DU = residential dwelling unit
 Gpcpd = gallons per capita per day

2.1 Phase 1 Summary of Annual Average Wastewater Flows

The wastewater flows generated for each land use have been calculated using the criteria and duty factors as discussed above. Based on these factors, it is estimated that the Phase 1 Tapestry development will generate approximately 579 acre-feet per year of wastewater annually on average. Table 2-2 below provides detailed summary of the demands by land use.

**Table 2-2
Phase 1 Summary of Average Domestic Water Demands by Land Use**

Land Use	Dwelling Units/ Acres	Average Annual Dry Weather Flows (ac-ft/yr)	Average Day Dry Weather Flows (MGD)
Low Density Residential	516 du	133	0.119
Low Medium Density Res.	1,587 du	411	0.367
Medium Density Residential	220 du	30	0.027
Schools	15 ac	5	0.004
Parks	75 ac	-	-
Total	5,247	579	0.517

MGD = million gallons per day, average annual demand

2.2 Wastewater Peaking Factors

In order to adequately size the infrastructure required for the project, the average annual dry weather flows presented in Table 2-2 need to be estimated for peak dry weather flow conditions. To estimate these conditions, the average annual demands are multiplied by a peak factor.

The peaking factors used for this study to determine the peak dry weather flows is the peaking equation recommended for use by the City in their current Wastewater Master Plan. The peaking equation is equation developed by the San Bernardino County Special Districts Department:

$$Q_{\text{peak}} = 2.5186 \times Q_{\text{average}}^{0.8992}$$

Based on the above peaking equation, the total peak dry weather flows generated by the Phase 1 development is estimated to be 1.39 MGD, or 2.15 cfs.

3.0 Phase 1 Wastewater Collection System Facilities

The wastewater collection facilities have been determined and sized in accordance with the City of Hesperia design criteria, and the criteria contained in the current Wastewater Master Plan. The following discussion summarizes the proposed sizing and design criteria for each of the facilities identified.

3.1 Phase 1 Infrastructure Sewer Mains

Gravity sewer mains are used throughout the development as much as feasible to collect wastewater flows to the proposed WWRP. For the vast majority of the gravity mains, they will be located within the street right of ways fronting the properties generating the wastewater. However, there are some areas where the easements through properties may be required in order to achieve gravity flow and limit the number of lift stations and force mains. This study is intended to address the Phase 1 backbone sewer infrastructure, not all the smaller in-tract mains to be required.

Gravity mains are to maintain a minimum of 8-ft of cover, unless deemed otherwise as necessary in unique situations, and the minimum pipe size is 8-inch diameter. The proposed gravity system ranges from 8-inch to 24-inch diameter pipes. The larger trunk mains may not be needed until the later phases, but are to be constructed as the ultimate pipeline diameter to avoid additional parallel pipeline construction in the later phases.

Table 3-1 is provided to show the pipe diameters and estimated total length of pipe proposed for the gravity system.

**Table 3-1
Gravity Mains**

Pipe Diameter	Approximate Pipe Length (ft)
8	91,208
12	9,380
21	911
24	3,465

3.2 Phase 1 Lift Stations

Although a gravity collection is desirable, there are some areas where low elevations require a sewer lift station to pump the wastewater to the high elevation where a gravity system can resume. There are 4 lift stations proposed to serve the Tapestry development Phase 1. Each lift station is assumed to include

inlet manholes, wet wells, submersible nonclog sewer pumps with electric motors, and emergency power generators.

The lift station pumping capacity is assumed to be peak dry weather flow tributary to the lift station. The following table is provided to show the flow capacity, total pump lift required or total dynamic head (TDH), and estimated total station horsepower. Each lift station is assumed to be equipped with two pumps, one duty pump and one standby pump. The total station horsepower is assumed to the horsepower for both pumps.

**Table 3-2
Phase 1 Proposed Sewer Lift Stations**

Lift Station	Approximate Flow Capacity (gpm)	Estimated Total Dynamic Head or Lift (ft)	Approximate Station Horsepower (Hp)
Lift Station 1	485	129	50
Lift Station 2	63	16	2
Lift Station 3	159	79	10
Lift Station 10	230	93	40

3.3 Phase 1 Force Mains

Each lift station will pump the wastewater from the low elevation to a high elevation through a sewer force main. Sewer force mains, as they are pressurized pipes, can be constructed at shallower depths than the gravity mains. However, force mains, as well as other sewer mains, will need to maintain the pipeline separation criteria from domestic water pipelines as established by the California Department of Health (CDH). All force mains will need to maintain minimum 10-foot horizontal separation from domestic water pipelines. Table 3-3 shows the force main pipe diameters and length for each lift station.

**Table 3-3
Phase 1 Force Mains**

Lift Station	Force Main Diameter (in)	Force Main Length (ft)
Lift Station 1	6	4,860
Lift Station 2	4	1,354
Lift Station 3	6	2,611
Lift Station 10	4	1,047

3.4 Wastewater Recycling Plant

The proposed Wastewater Recycling Plant (WWRP) is located at a low point in the north eastern portion of the project. The WWRP will treat Tapestry wastewater to Title 22 regulations for the treated effluent to be used for irrigation water for the project. The WWRP is located on a site approximately 13 acres. An onsite equalization pond, or storage pond, will be provided for effluent equalization prior to being pumped into the recycled water distribution system for irrigation or other intended uses. Based on the analysis herein, the WWRP for Phase 1 will be sized to 0.5 MGD average flows, with peak flow capacity 1.4 MGD during dry weather conditions.

To limit the footprint of the WWRP, the plant should be a membrane filtration plant (MBR). Process design and facility layouts will be in accordance with the City's Wastewater Master Plan. The WWRP will be constructed for phased capacity as the development phases of the project are completed. Each phase will be required to analyze projected peak flow conditions of the next proposed phase. The facility will then be upgraded as necessary to allow future phased units to be brought online (unless otherwise determined acceptable by the City of Hesperia).

4.0 Hydraulic Model Analysis

A hydraulic model analysis was performed to evaluate the proposed gravity pipelines to determine approximate pipeline diameters required for the project, as well as lift station capacity and pumping requirements. Pipeline analysis and design criteria as stated in the City's current design criteria and Wastewater Master Plan were utilized.

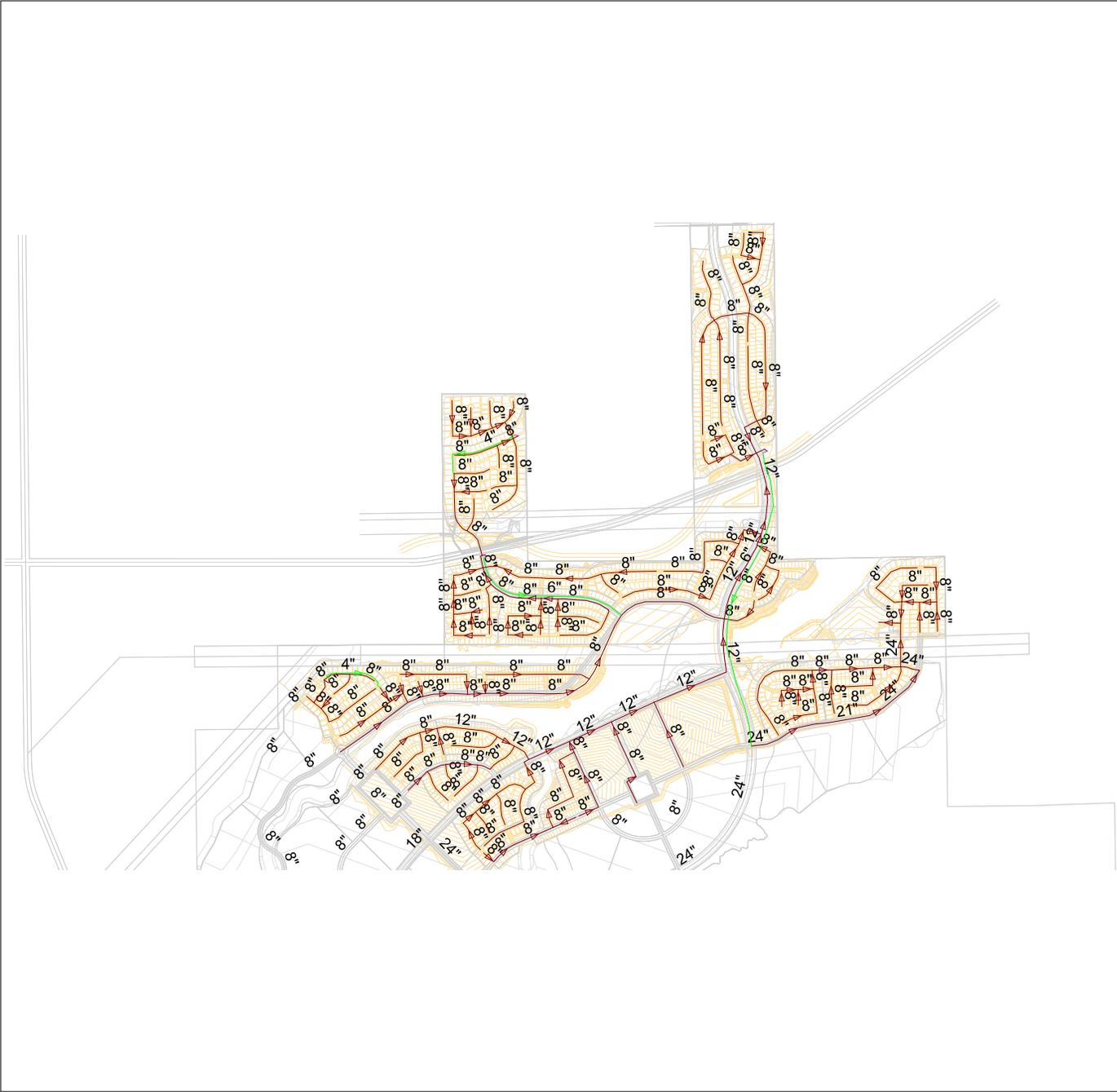
The minimum depth for gravity sewers is 8-ft, and minimum pipe diameter is 8-inch. Pipe slopes for all 8-inch pipes are limited to a minimum slope of 0.004. Minimum pipe slopes are in accordance with the City's Wastewater Master Plan. The following criteria were also used in determining pipe diameter sizing:

Minimum Pipe Velocity =	2 fps
Maximum Pipe Velocity =	10 fps
Maximum d/D for diameter < 15-inch =	0.50
Maximum d/D for diameter \geq 15-inch =	0.75
Pipe roughness coefficient =	0.013

The minimum pipe slope used in the analysis was 0.004 for 8-inch pipes, 0.0022 for 12-inch pipeline, and 0.003 for 15-inch and larger pipelines.

The model analysis results yield the pipe diameters as shown in Figure 1. The analysis showed that there were some pipes that had velocity less than 2 fps for 8-inch pipes at the most upstream reaches of the sewer with small flows and relatively flat slopes. These locations follow the proposed grading and are considered to be acceptable for this level of analysis and should be evaluated again during the design stage of the project with actual slopes.

Additionally, sewer manholes and pipes were generally limited to about 15-ft deep.



Links (TYPE)

-  Gravity Main
-  Force Main
-  Pump

tapestry base



tapestry mass grade



TTM PH1

