IRIS DEVELOPMENT SERVICES
PLLC

TECHNICAL MEMORANDUM

To: Mike Wolfe, PE

From: Mac Hall, PE

Re: Havasu Foothills – Villas Estates – Collection System Analysis

Date: April 2021
Revised: January 2025

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 68493
MARION HALL
Date Signed 01/10/2025
ARIZONA, U.S.A.
Expires 03/31/2025

1.   Introduction/Purpose

The Villas Estates is a development within Havasu Foothills Estates that is proposed to have 21 residential lots. The recently adopted "Sewer Master Plan for Havasu Foothills Estates" (Master Plan), prepared by ARQ Engineering and revised in December 2016, was adhered to for the design of the wastewater collection system in this development. The purpose of this memorandum is to document the design of the wastewater collection system in The Villas Estates and show that the applicable design requirements are satisfied.

2.   Location

The site is located on the northeastern edge of Lake Havasu City (**Figure 1**). Layout of the proposed collection system within the development is shown in **Figure 2**. The collection system is proposed to have a lift station on the west end of Havasu Estates, which will pump to the existing gravity sewer to the east.

## 3.   Design Standards and Performance Requirements

Sanitary sewer facilities will be sized to meet the design standards as described in the Lake Havasu City Sewer Design Standards and Specifications and Arizona Administrative Code, and are specifically listed below:

1. Residential daily design flows = 80 gallons per capita per day (gpcd);
2. 2.26 people per dwelling unit;
3. Dry Weather Peaking Factor = 3.62 (assuming upstream population of 0);
4. Wet Weather Peaking Factor = 1.1;
5. Minimum pipe size = 8 inches in diameter (except for dead end lines that are less than 400 feet in length and not proposed for future extension);
6. Minimum slope = 0.0034 ft/ft for 8-inch diameter; 0.0110 ft/ft for 6-inch diameter;
7. Maximum velocity = 10 ft/s.
8. Minimum Force Main Velocity = 3 ft/sec.
9. Minimum Force Main Size = 4-inch diameter.

Figure 1 – Aerial map of Lake Havasu showing project location.

Figure 2 –Service Area Map
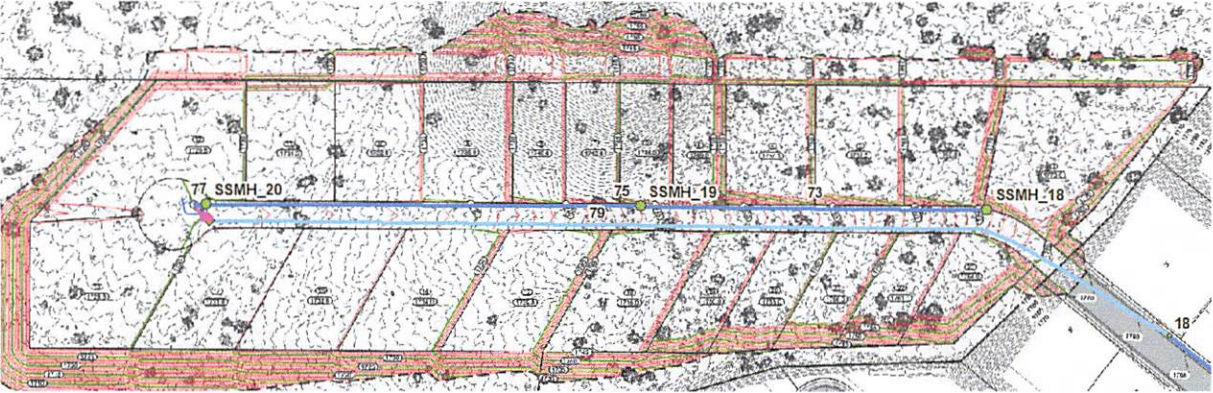
4.   Analysis of Proposed Infrastructure

The Villas Estates consists of 21 residential units.   The following calculations were used for determining the estimated wastewater flows at completion of the development:

1. Population = 21 dwelling units x 2.26 people per dwelling unit = 48 people;
2. Daily Residential Flow = 80 gpcd x 48 people = 3,840 gpd
3. Dry Weather Peak Flow = 3,840 x 3.62 = 13,901 gpd = 0.014 MGD
4. Wet Weather Peak Flow = 13,901 x 1.1 = 15,291 gpd = 0.015 MGD

The sewer lines in The Villas Estates are designed with a minimum slope of 0.023 ft/ft and a maximum slope of 0.055 ft/ft, with a minimum gravity pipe size of 6-inch. At the minimum recommended slope of 0.0034 ft/ft, an 8-inch PVC pipeline has a capacity of approximately 0.17 MGD, which would provide sufficient capacity for the proposed development based on the calculations shown above. Furthermore, the minimum slope of 0.023 ft/ft for 8-inch pipelines meets the minimum slope required by the Lake Havasu City Sewer Design Standards and Specifications. The corresponding velocities at minimum and maximum slopes when flowing full are 5.26 ft/s and 6.71 ft/s, respectively, which meet the minimum and maximum velocities required.

A hydraulic model was constructed to analyze the proposed collection system and determine the depths of flow in the pipes. *Figure 3* shows the maximum depth over diameter of each gravity pipe within the collection system. Based on the hydraulic analysis, a 4-inch force main is recommended. The pumps are recommended to have a design flow of 120 gpm in order to achieve the minimum required velocities, and a head of 60 feet. The tables attached at the end of this document provide the results of the hydraulic model for Villas Estates. Downstream pipelines have previously been analyzed, and those reports have previously been submitted.

Figure 3 – Maximum depth over diameter

5.   Summary

The proposed sanitary sewer infrastructure shown in the Project Drawings comply with Lake Havasu City Sewer Design Standards and Specifications and Arizona Administrative Code, meeting the applicable design requirements.

Gravity Main Analysis Results

ID	From ID	To ID	Diameter (in)	Length (ft)	Slope	Total Flow (gpm)	Velocity (ft/s)	d/D	Water Depth (ft)	Full Flow (gpm)
73	SSMH_18	SSMH_19	6.000	398.018	0.055	6.047	2.300	0.069	0.034	643.113
75	SSMH_19	SSMH_20	8.000	498.186	0.027	12.093	2.114	0.079	0.052	962.567
77	SSMH_20	9000	8.000	13.035	0.023	18.140	2.269	0.099	0.066	893.727

Force Main Analysis Results

ID	From ID	To ID	Diameter (in)	Length (ft)	Total Flow (gpm)	Velocity (ft/s)	Headloss (ft)
79	SSMH_21	18	4.000	1,132.890	18.140	3.064	11.129

Note: The total flow presented above is the peak flow into the lift station. As mentioned above, the pump is to be sized with a flow rate of 120 gpm.