

## LOW PRESSURE SANITARY SEWER STUDY

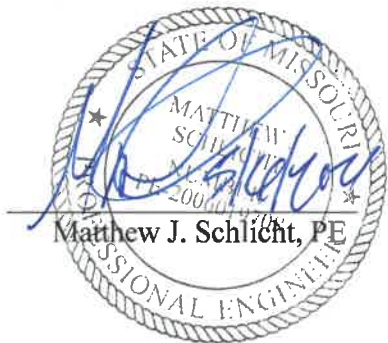
## WOODLAND OAKS

SW Corner Colbern &amp; Blackwell

**Site Acreage: 20.81 Acres**

## Lee's Summit, MO

**PREPARED BY:**



## Revision

Date	Comment	By

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Date	Comment	By

Matthew J. Schlicht, PE

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### 3. GENERAL INFORMATION

This study has been prepared to evaluate a low pressure sewer (LPS) alternative for partial sanitary service of the proposed single family residential subdivision, Woodland Oaks. Due to topographic challenges, gravity sanitary sewers are not able to serve all areas of the development. The proposed development shall consist of 42 single family residential lots. The site is located at the southwest corner of Colbern Road and Blackwell Road. The property is bound by Colbern Road to the north, Blackwell Road to the east, Woodland Shores a single family residential subdivision to the south and a large acre single family tract to the west. Woodland Oaks is tributary to Lake Jacomo which is located to the northwest just across Colbern Road. The site is a tract of land located in the SE ¼ of Section 27, Township 48 North, and Range 31 West. See Exhibit A for an aerial view of the site along with the surrounding area.

### 4. METHODOLOGY

LPS capacity and hydraulic criteria shall at a minimum conform to Missouri Department of Natural Resources (MDNR) Minimum Design Requirements as outlined in 10 CSR 20-8.

- Velocity. Design shall be based on the most probable number of pumping units expected to operate simultaneously or on some other acceptable method of computing the peak pumpage rate. Environment One Corporation (E/One) Design Assistant 9 Software will be used to determine most probable number of pumping units expected to operate simultaneously along with associated peak velocities. E/One is a leader in the LPS field and has numerous time tested systems operating successfully throughout Missouri.
- A cleansing velocity of at least two feet per second (2 fps), at least once and preferably several times per day, shall be achieved. Projected velocities may be found in the E/One design report located in the Appendix.
- Minimum size. The minimum diameter sewer main pipe shall not be less than one and a half inches (1.5"). The minimum 1.5" forcemain size will handle a maximum of three homes. The use of 1.5" main in lieu of 2" will depend on lot layout and configuration.
- Service Line Connection. The minimum diameter service line pipe shall be one and one quarter inches (1.25"). Per discussion with the City a lateral assembly consisting of both a ball and check valve shall be located 5 feet from the forcemain. The City will own and maintain everything downstream of the isolation ball valve. The HOA or Private Resident shall own, operate and maintain the lateral assembly and all appurtenances upstream including the simplex grinder pump station and control panel. The LPS system shall terminate at the edge of the sanitary easement with a capped 1.25" service line.
- Simplex grinder pump station shall not serve multiple equivalent dwelling units (EDU) if owned, operated, and maintained by individual homeowners; and not serve commercial facilities.
- Storage volume. A grinder pump vault shall have a storage volume of at least seventy (70) gallons.
- Design Flow. Single family lots are projected to produce average daily flows of 370 gpd each (100 gpd per capita x 3.7 capita/dwelling). Peak hour demand per lot is 1647 gpd or 1.14 gpm (370 gpd x 4.45 Peak Factor) well below the proposed pump capacity of 11 gpm. A pump curve for the proposed grinder pumps may be found in the Appendix.
- The roughness coefficient, C for the proposed pipe shall be 120.

In addition to developing a scouring velocity of 2 fps in the system a maximum fluid retention time in the system should be less than 24 hours to minimize creation of septic conditions. These two parameters along with total dynamic head will be the basis of design for the proposed forcemains.

## **5. LPS SYSTEM DESIGN**

The development consists of 42 lots of which 22 of them will be served by the LPS system. The LPS system will be comprised of two independent branches (forcemains) each connected to a new manhole labeled A-1 for further gravity conveyance downstream to the Woodland Shores Pump Station. Forcemain 1 will be located in the west portion of the development and will run along NE Woodland Oaks Circle. Forcemain 2 will be located in the eastern portion of the development and will run along NE Cherrybark Court. A proposed general layout for the combination sanitary sewer system may be found in Exhibit B.

Service lines and all upstream appurtenances shall be 1.25". Service line shall be HDPE SDR-11 and terminate at the edge of easement with a pipe cap. All lateral assemblies shall be placed 5' from the forcemain to minimize non-isolatable service line while allowing emergency shutoff of the residence. The public forcemain will commence just downstream of the ball valve. The lateral assembly which consists of the ball and check valve shall be privately owned along with all line and appurtenances upstream including the simplex grinder station and the control panel.

### **5.1 GRINDER PUMPS**

The low-pressure sewer system design was based on the DH071 grinder pump manufactured by E/One Sewer Systems. These units feature a 1 horsepower motor and have a typical discharge of 11 gpm at 40 psi. They have a storage capacity of 70 gallons and are rated by the manufacturer for up to 700 gallons per day. The manufacturer's pump curve may be found in Exhibit C. Each pump will have an internal check valve and will be installed with a gate valve on the service lateral near the property line. Additionally, each pump will be installed with a control panel that includes a high level alarm. The grinder pump stations and additional service line shall be installed with construction of the homes.

### **5.1 FORCEMAIN**

The forcemain design was completed using software developed by E-One along with guidance provided by the pump manufacturer. The design involves breaking the system down into zones, with each zone defined by a given number of pump connections. Zone 1 is typically located furthest away from the receiving structure with subsequent zones being added at all branches and changes in pipe size. The branch structure facilitates pipe sizing for each zone based upon a statistically probable number of simultaneous pump operations. Pipe sizes were determined by requiring a minimum velocity of 2 feet per second for average daily flows, as well as maintaining a maximum fluid retention time in the system of less than 24 hours. The required pipe material is HDPE SDR-11. All branches shall terminate with an end of line flushing assembly.

The two forcemains were modeled with four zones, two zones for each. Zones 1 and 2 makeup Forcemain 1. Zones 3 and 4 makeup Forcemain 2. There are 15 lots contributing to Forcemain 1 and 7 lots contributing to Forcemain 2. Both forcemains will consist of 2" pipe throughout their runs. The maximum pressure in the system occurred in Zone 1 at 81.70 feet of head, which is less than the 185 feet recommended by the pump manufacturer. Zone 1 consists of the first three lots on Forcemain 1. Maximum scouring velocities of 2 fps were obtained in all four zones with the lowest scouring velocity occurring in Zone 1 at 2.38 fps. The maximum retention time was calculated at 1.07 hours in Zone 1. The final design calculations are summarized and provided in Exhibit D.

## **6. CONCLUSIONS & RECOMMENDATIONS**

An LPS system will be able to provide sanitary sewer service for 22 residences in the proposed development without any adverse impacts to the community or downstream sanitary system. We recommend that an LPS

system as described in this report and consisting of two 2" forcemains be constructed to service the 22 residences as shown on the general layout.

# **Exhibit A**

## **Aerial Images**



NE Colbern Rd

SITE

NE Blackwell Rd

323 ft

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Google Earth

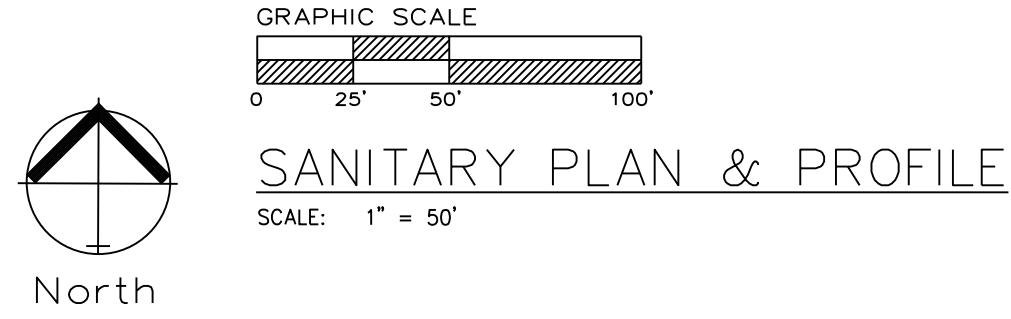
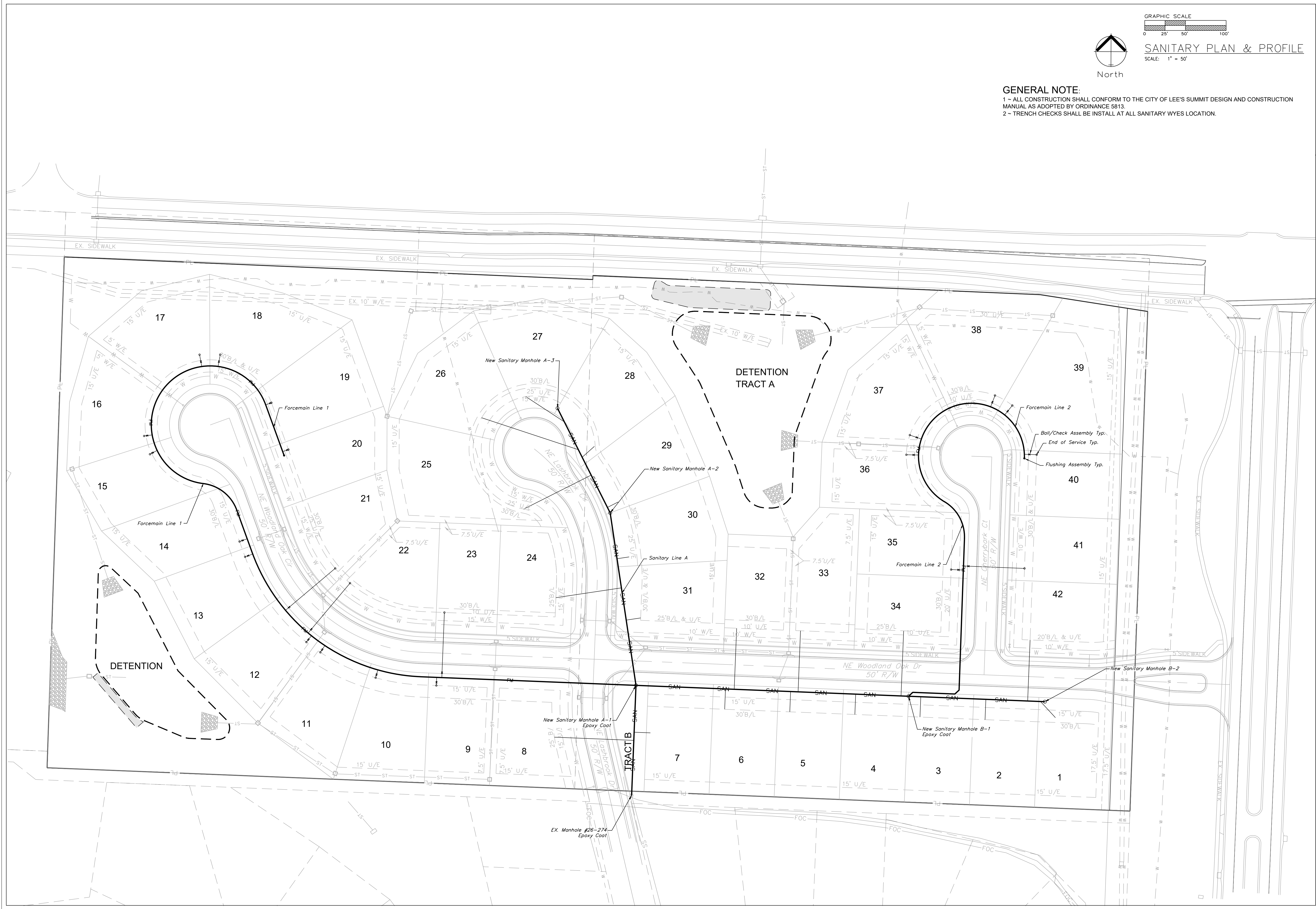






# **Exhibit B**

## **Sanitary Sewer General Layout**



GENERAL NOTE:  
 1 ~ ALL CONSTRUCTION SHALL CONFORM TO THE CITY OF LEE'S SUMMIT DESIGN AND CONSTRUCTION MANUAL AS ADOPTED BY ORDINANCE 5813.  
 2 ~ TRENCH CHECKS SHALL BE INSTALL AT ALL SANITARY WYES LOCATION.

**ENGINEERING SOLUTIONS**  
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Professional Registration  
 Missouri  
 Engineering 2005002186-D  
 Surveying 2005008319-D  
 Kansas  
 Engineering E-1685  
 Surveying LS-218  
 Oklahoma  
 Engineering 6254  
 Nebraska  
 Engineering CA2821

Sanitary Sewer General Layout  
 Construction Plans for:  
 WOODLAND OAKS  
 Lots 1 thru 42  
 Lee's Summit, Jackson County, Missouri

Project:  
 WOODLAND OAKS  
 LSMO  
 Issue Date:  
 February 25, 2021

Part of the Southeast 1  
 Section 27, Township 48 North, Range 31 West  
 Lee's Summit, Jackson County, Missouri

STATE OF MISSOURI  
 MATTHEW J. SCHLICHT  
 PROFESSIONAL ENGINEER  
 LICENSE NO. 19071  
 EXPIRATION DATE 12/31/2025

Matthew J. Schlicht  
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 KS PE 19071  
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 NE PE E-14335

REVISIONS  
 REV. 4-21-21

C. 401

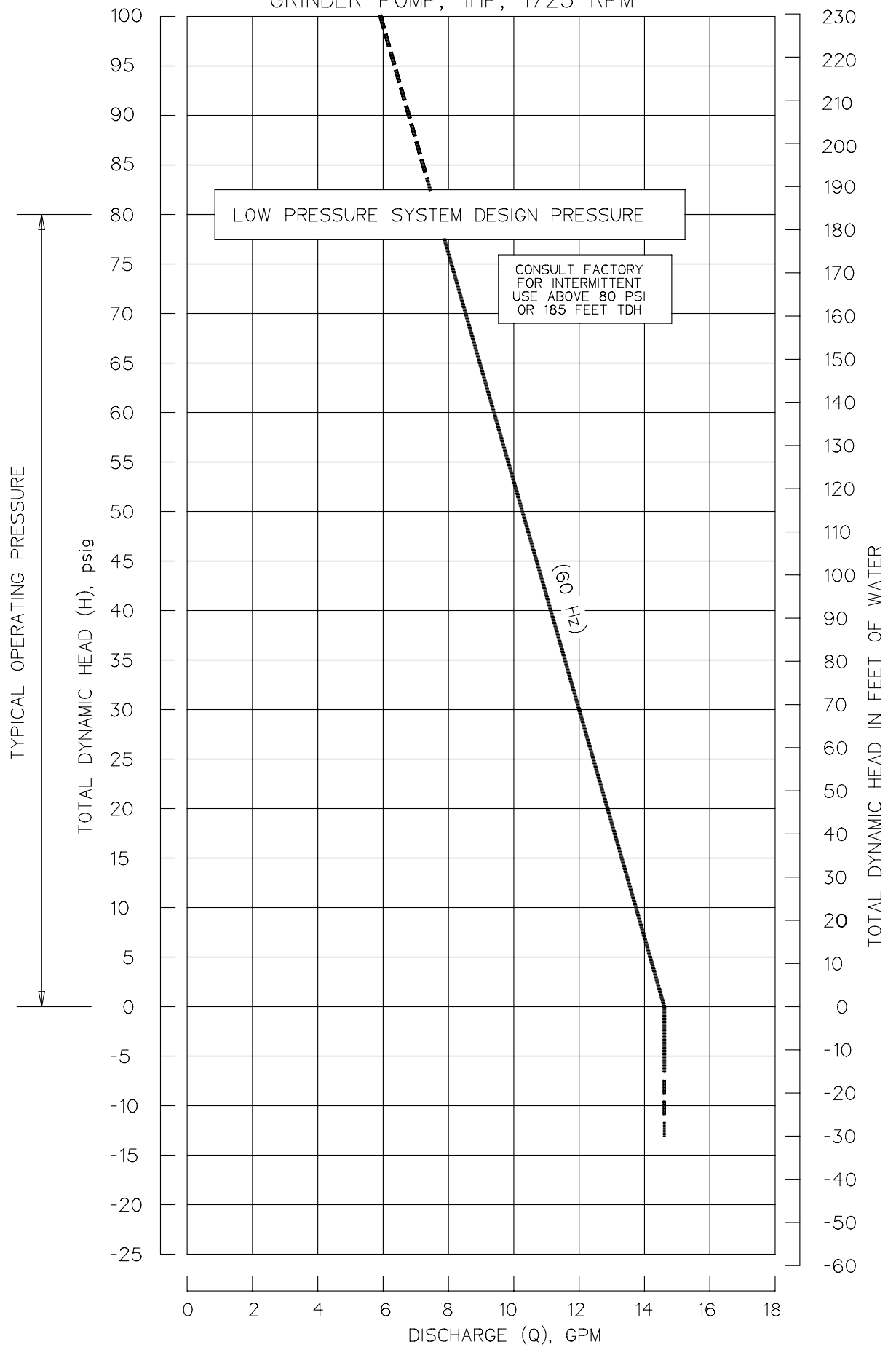
# **Exhibit C**

## **E/One Grinder Pump Flow Curve**



# E|ONE SPD PUMP PERFORMANCE CURVE

GRINDER PUMP, 1HP, 1725 RPM



# **Exhibit D**

## **E/One Design Summary**



Environment One Corporation

**Pressure Sewer Preliminary  
Design Analysis For  
Woodland Oaks**

**Prepared For:**

**Tel:**

**Fax:**

**Prepared By: AEP**

**April 22, 2021**

# PRELIMINARY PRESSURE SEWER - PIPE SIZING AND BRANCH ANALYSIS

Prepared By:  
AEP

Woodland Oaks

April 22, 2021

Zone Number	Connects to Zone	Number of Pumps in Zone	Accum Pumps in Zone	Gals/day per Pump	Max Flow Per Pump (gpm)	Max Sim Ops	Max Flow (GPM)	Pipe Size (inches)	Max Velocity (FPS)	Length of Main this Zone	Friction Loss Factor (ft/100 ft)	Friction Loss This Zone	Accum Friction Loss (feet)	Max Main Elevation	Minimum Pump Elevation	Static Head (feet)	Total Dynamic Head (ft)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE										Friction loss calculations were based on a Constant for inside roughness"C" of: 120							
1.00	2.00	3	3	370	11.00	2	22.00	2.00	2.38	145.13	1.80	2.61	59.50	947.20	925.00	22.20	81.70
2.00	2.00	12	15	370	11.00	4	44.00	2.00	4.76	876.78	6.49	56.89	56.89	947.20	925.00	22.20	79.09
3.00	4.00	3	3	370	11.00	2	22.00	2.00	2.38	80.71	1.80	1.45	20.48	958.00	941.00	17.00	37.48
4.00	4.00	4	7	370	11.00	3	33.00	2.00	3.57	499.55	3.81	19.03	19.03	958.00	941.00	17.00	36.03



## PRELIMINARY PRESSURE SEWER - ACCUMULATED RETENTION TIME (HR)

Woodland Oaks

Prepared By:

AEP

April 22, 2021

Zone Number	Connects to Zone	Accumulated Total of Pumps this Zone	Pipe Size (inches)	Gallons per 100 lineal feet	Length of Zone	Capacity of Zone	Average Daily Flow	Average Fluid Changes per Day	Average Retention Time (Hr)	Accumulated Retention Time (Hr)
This spreadsheet was calculated using pipe diameters for: SDR11HDPE							Gals per Day per Dwelling		370	
1.00	2.00	3	2.00	15.40	145.13	22.35	1,110	49.66	0.48	1.07
2.00	2.00	15	2.00	15.40	876.78	135.05	5,550	41.10	0.58	0.58
3.00	4.00	3	2.00	15.40	80.71	12.43	1,110	89.29	0.27	0.98
4.00	4.00	7	2.00	15.40	499.55	76.94	2,590	33.66	0.71	0.71