SEWER BASIS OF DESIGN

Arabella Spa
725 State Route 179

Prepared for:

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Sedona, Arizona 86336

Prepared by:

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2916590000
March 2022
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Preliminary Sewer Basis of Design

ARABELLA SPA

725 STATE ROUTE 179

MARCH 2022

Prepared By:

Kimley»Horn

Contents

Introduction 1
Intent 1
Project Description 1
Distribution System Description 1
Existing collection System 1
Proposed Collection System 1
Basis of Design 2
Design Methodology 2
Wastewater System Anaylsis and Results 3

Tables

Table 1 Sewer Demands 2

Appendices

Appendix A – Site Location Map
Appendix B – Proposed Sewer System Layout
Appendix C – Flow Calculations

INTRODUCTION

INTENT

The purpose of this sewer report is to support the sanitary sewer system for the proposed 20,000 sf spa development located at 725 State Route 179 in Sedona, Arizona. This report represents the basis of design criteria that will be used for the engineering design of the proposed development utilizing the standards and guidelines set forth in the Arizona Administrative Code (AAC).

PROJECT DESCRIPTION

Arabella Spa is located within Section 18, Township 17 North, Range 6 East of the Gila and Salt River Base and Meridian, Coconino County, Arizona. The site is bound by Arabella Hotel to the west, Sombart Lane to the north, open space to the east, and residential development to the south, See **Appendix A: Site Location Map**.

Arabella Spa is a proposed 21,000 sf spa development that includes grading, drainage, and utility improvements. The existing zoning of the project is Commercial (CO).

DISTRIBUTION SYSTEM DESCRIPTION

EXISTING COLLECTION SYSTEM

The site is surrounded by existing commercial and residential development. There is an existing sewer main to the north of the site in Sombart Lane where the service line will connect.

PROPOSED COLLECTION SYSTEM

The gravity sewer system will connect into the existing sewer manhole in Sombart Lane. The proposed on-site collection system will connect into the existing main and consist of approximately 555-feet of 4-inch PVC gravity sewer that will collect and convey wastewater flows generated by the spa and restaurant. The system will also incorporate a grease interceptor for building 1 that shall be sized per Arizona Administrative Code and a grease interceptor for building 4.

BASIS OF DESIGN

DESIGN METHODOLOGY

Average Day Demand design flows are calculated based on design criteria detailed within the Arizona Administrative Code. Per Title 18, Environmental Quality chapter 9, Department of Environmental Quality Article 3, Aquifer protection permits part E, a design flow of 20 gallons per employee shall be used for Restaurant/Cafeteria, 6 gallons per meal shall be used for Kitchen Waste, 1 gallon per meal for Garbage Disposal Waste, and 2 gallons per meal for Kitchen Waste Disposal Service. A flow of 200 gallons was used for the restrooms. There are 14 shower units, each requiring a flow of 180 gallons. A design flow of 50 gallons per wash cycle was used for each laundry unit. A design flow of 30 GPD was used for the spas (pools). The steam room flow (sauna) was estimated at 54 gallons. The Arizona Administrative Code also requires a dry peaking factor of 3.62 for new lines and a wet weather infiltration percentage of peak dry flow rate of 10%. See **Table 1** below for a summary of base daily sewer demand flows.

Table 1 Sewer Demands

Building	***Use***	***Sewage Demand Rate***		***Demand Criteria***		***Sewage Design Flow [GPD]***
		gpd	***unit***	***No.***	***unit***	
Building 1	Restaurant	20	EMPLOYEE	20	EMPLOYEE	400
	Kitchen Waste	6	MEAL	200	MEAL	1200
	Garbage Disposal	1	MEAL	200	MEAL	200
	Kitchen Waste Disposal Service	2	MEAL	200	MEAL	400
	Bar	2	CUSTOMER	100	CUSTOMER	200
	Restroom	200	TOILET	10	TOILET	2000
	Shower	180	SHOWER	14	SHOWER	2520
	Pool	30	POOL	1	POOL	30
	Laundry: 3 Units	50	WASH CYCLE	3	WASH CYCLE	450
Building 2	Pool	30	POOL	1	POOL	30
Building 3	Pool	30	POOL	1	POOL	30
	Pool	30	POOL	1	POOL	30
	Steam Room	54	DAY	1	DAY	54
	Shower	180	SHOWER	3	SHOWER	540
Building 4	Outdoor Kitchen	20	EMPLOYEE	6	EMPLOYEE	120

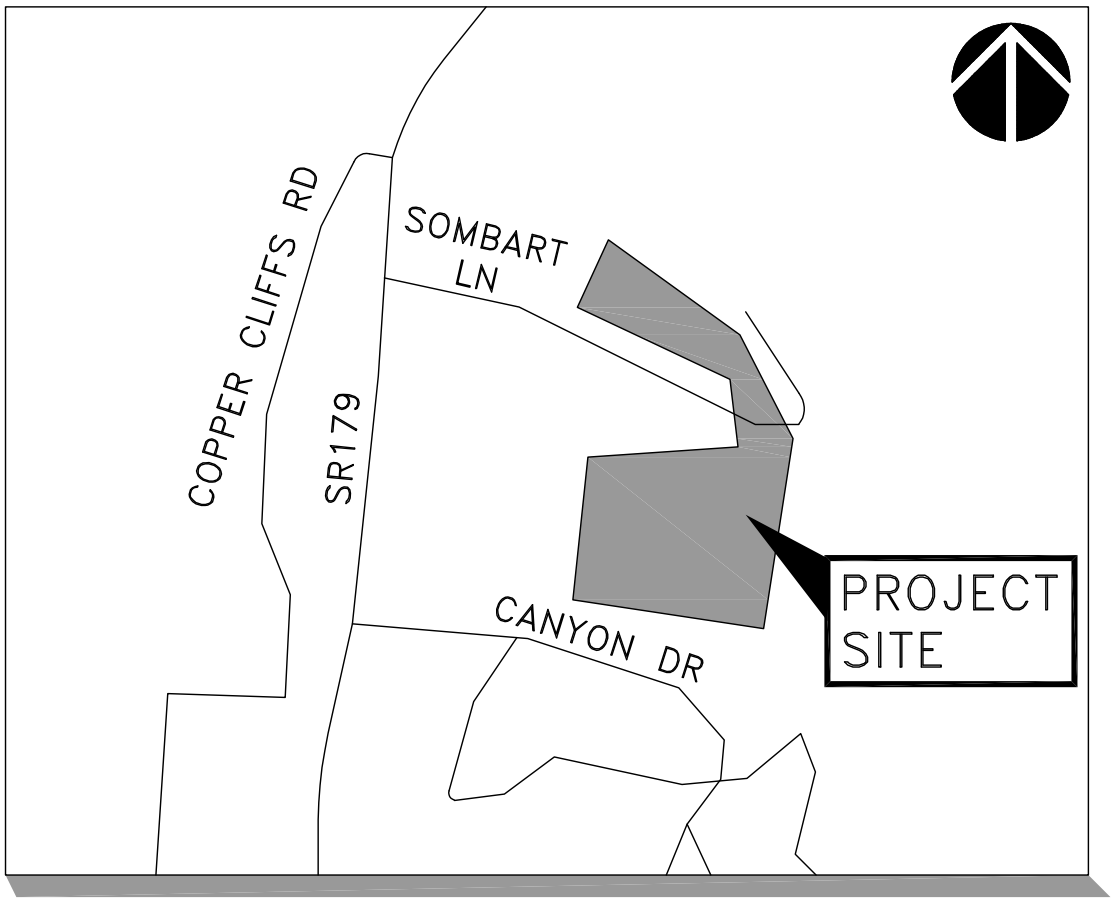
	Kitchen Waste	6	MEAL	25	MEAL	150
	Garbage Disposal	1	MEAL	25	MEAL	25
	Kitchen Waste Disposal Service	2	MEAL	25	MEAL	50
	Outdoor Bar	2	CUSTOMER	50	CUSTOMER	100
	Restroom	200	TOILET	2	TOILET	400
	Pool	30	POOL	1	POOL	30
	Pool	30	POOL	1	POOL	30
					Total	**8,989**
					Peak Flow (With Dry Peaking Factor)	**32,450**
					Peak Flow (Wet-Weather)	**35,704**

Per the Arizona Administrative Code (AAC), the proposed sewer lines were designed to achieve full flow velocity between 2 and 10 feet per second. To satisfy these requirements the proposed private 4-inch sanitary sewer will be designed with a minimum slope of 0.009 ft/ft. See **Appendix C** for pipe slope calculations.

WASTEWATER SYSTEM ANAYLSIS AND RESULTS

To determine the capacity of the proposed wastewater collection system, the peak design flow was analyzed within the minimum design pipe slope. At the minimum design slope of 0.125 in/ft (1/8”/ft), a 4-inch, has the capacity to convey approximately 125,532 gallons per day. A proposed system can convey the proposed peak design flow of 35,704 gallons per minute at a d/D ratio of 0.45. **See Appendix C – Flowmaster Calculations** for pipe capacity calculations.

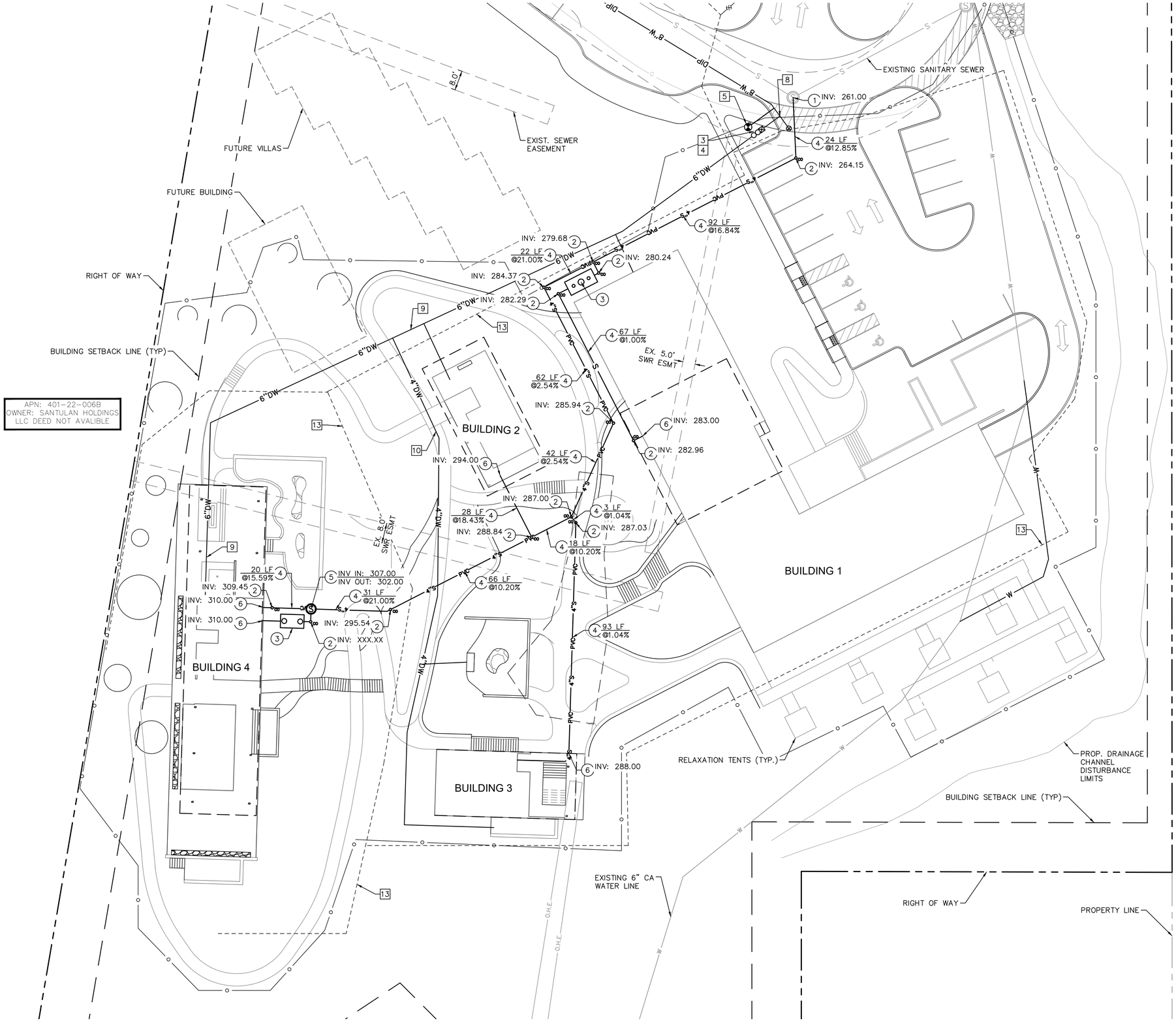
Appendix A – Site Location Map

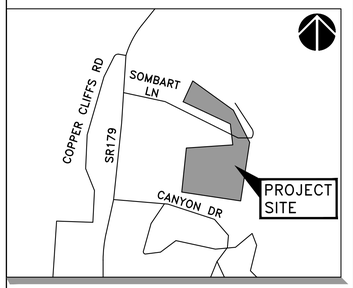


VICINITY MAP

CITY OF SEDONA
N.T.S.

Appendix B – Proposed Sewer System Layout





VICINITY MAP

CITY OF SEDONA
N.T.S.

WATER CONSTRUCTION NOTES

3. 6" WATER METER ASSEMBLY & VALVE
4. 6" BACKFLOW PREVENTER
5. FIRE HYDRANT ASSEMBLY
6. FIRE DEPARTMENT CONNECTION PER SEDONA FIRE DEPARTMENT STD DTL
8. TAPPING SLEEVE AND VALVE
9. 6" PVC DOMESTIC WATER LINE
10. 4" DOMESTIC WATER LINE
13. 1.5" IRRIGATION MAIN LINE, SEE ARCHITECTURAL PLANS

SEWER CONSTRUCTION NOTES

1. CONNECT TO EXISTING SEWER MANHOLE, INVERT PER PLAN
2. INSTALL 4" CLEANOUT PER MAG STD DTL 441, INVERT PER PLAN
3. INSTALL GREASE INTERCEPTOR WITH TWO-WAY CLEANOUT, SIZE PER MANUFACTURER.
4. INSTALL 4" PVC SDR 35 SEWER LINE, LENGTH AND SLOPE PER PLAN. TRENCH, BEDDING, AND BACKFILL PER MAG STD DTL 200-1.
5. 5' DIA. PRECAST CONCRETE SEWER MANHOLE PER MAG STD DTL 420-1, 426Q-1 AND 30" CAST IRON MANHOLE FRAME AND COVER PER MAG STD DTL 423-2, INVERT PER PLAN
6. CONNECT TO BUILDING, REFER TO PLUMBING PLANS

PRIVATE UTILITY NOTES

1. PRIVATE UTILITY LOCATIONS SHOWN ARE APPROXIMATE AND SHALL BE VERIFIED. PROPOSED UTILITY ROUTING ARE SHOWN FOR TRENCHING, CONDUIT, AND BACKFILL ESTIMATION. COORDINATE WITH UTILITY OWNER ON EXACT LOCATIONS AND CONSTRUCTION INFORMATION.

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SCALE (V): N/A
DESIGNED BY: JWL
DRAWN BY: JTH
CHECKED BY: ACB
DATE: MAR 2022

ARABELLA SPA PRELIMINARY IMPROVEMENT PLANS
UTILITY SHEET
95 N SOMBART LANE SEDONA, AZ

PRELIMINARY
FOR REVIEW ONLY
NOT FOR CONSTRUCTION
Kimley»Horn
ENGINEER ANDREW BAIRD
PE NO. 48841 DATE 3/29

PROJECT NO.
291659000

DRAWING NAME
UT01

K:\PRS_Roadway\291659000 - Arabella Spa\CAD\PlanSheets\UT01.dwg Mar 25, 2022 Jake.Levin
XREFS: dBM_291659000 xTB_291659000 xUT_291659000 xNUT_291659000 xBNDY_291659000
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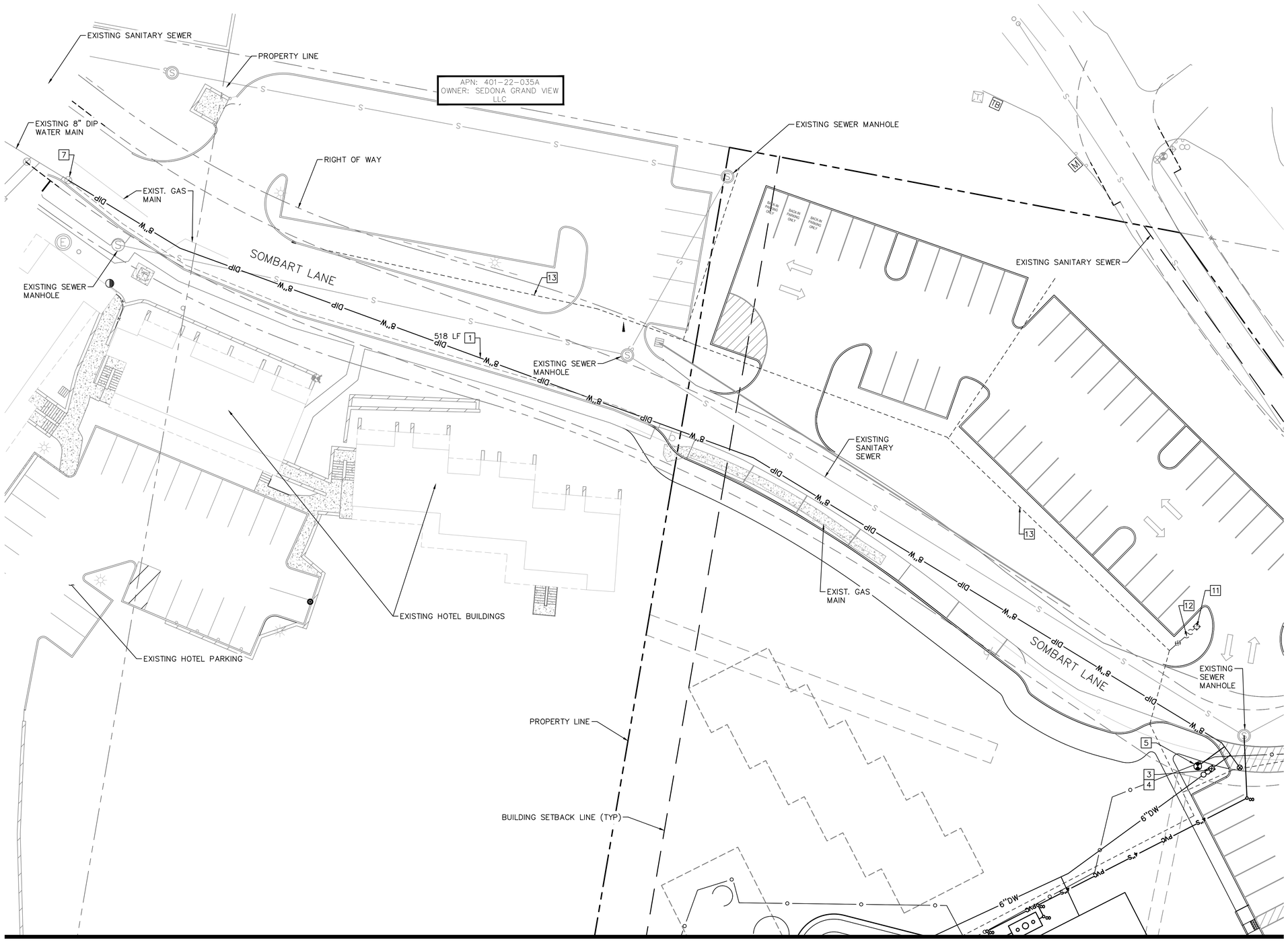
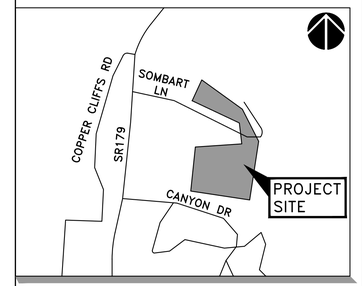


MATCHLINE SEE SHEET 05 FOR CONT.



VICINITY MAP

CITY OF SEDONA
N.T.S.

WATER CONSTRUCTION NOTES

1. 8" DIP WATER MAIN
3. 6" WATER METER ASSEMBLY & VALVE
4. 6" BACKFLOW PREVENTER
5. FIRE HYDRANT ASSEMBLY
6. FIRE DEPARTMENT CONNECTION PER SEDONA FIRE DEPARTMENT STD DTL
7. CONNECT TO EXISTING WATER MAIN
11. 2" IRRIGATION METER, SEE LANDSCAPE PLANS
12. 2" BACKFLOW PREVENTER, SEE LANDSCAPE PLANS
13. 1.5" IRRIGATION MAIN LINE, SEE ARCHITECTURAL PLANS

PRIVATE UTILITY NOTES

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ENGINEER ANDREW BAIRD
PE NO. 48841 DATE 3/29

PROJECT NO.
291659000

DRAWING NAME
UT02

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XREFS: dBM_291659000 xTB_291659000 xUT_291659000 xNUT_291659000 xBNDY_291659000 xTOPO_291659000
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Appendix C – Flow Calculations

TITLE 18. ENVIRONMENTAL QUALITY
CHAPTER 9. DEPARTMENT OF ENVIRONMENTAL QUALITY
ARTICLE 3. AQUIFER PROTECTION PERMITS
PART E. TYPE 4 GENERAL PERMITS

Table 1. Unit Design Flows

Wastewater Source	Applicable Unit	Sewage Design Flow per Applicable Unit, Gallons Per Day
Airport	Passenger (average daily number) Employee	4 15
Auto Wash	Facility	Per manufacturer, if consistent with this Chapter
Bar/Lounge	Seat	30
Barber Shop	Chair	35
Beauty Parlor	Chair	100
Bowling Alley (snack bar only)	Lane	75
Camp Day camp, no cooking facilities Campground, overnight, flush toilets Campground, overnight, flush toilets and shower Campground, luxury Camp, youth, summer, or seasonal	 Camping unit Camping unit Camping unit Person Person	 30 75 150 100-150 50
Church Without kitchen With kitchen	 Person (maximum attendance) Person (maximum attendance)	 5 7
Country Club	Resident Member Nonresident Member	100 10
Dance Hall	Patron	5
Dental Office	Chair	500
Dog Kennel	Animal, maximum occupancy	15
Dwelling For determining design flow for sewage treatment facilities under R18-9-B202(A)(9)(a) and sewage collection systems under R18-9-E301(D) and R18-9-B301(K), excluding peaking factor.	Person	80

Dwelling For on-site wastewater treatment facilities per R18-9-E302 through R18-9-E323: Apartment Building 1 bedroom 2 bedroom 3 bedroom 4 bedroom Seasonal or Summer Dwelling (with recorded seasonal occupancy restriction) Single Family Dwellings Other than Single Family Dwelling, the greater flow value based on: Bedroom count 1-2 bedrooms Each bedroom over 2 Fixture count	 Apartment Apartment Apartment Apartment Resident see R18-9-A314(D)(1) Bedroom Bedroom Fixture unit	 100 see R18-9-A314(D)(1) 300 150 25
Fire Station	Employee	45
Hospital All flows Kitchen waste only Laundry waste only	 Bed Bed Bed	 250 25 40
Hotel/motel Without kitchen With kitchen	 Bed (2 person) Bed (2 person)	 50 60
Industrial facility Without showers With showers Cafeteria, add	 Employee Employee Employee	 25 35 5
Institutions Resident Nursing home Rest home	 Person Person Person	 75 125 125
Laundry Self service Commercial	 Wash cycle Washing machine	 50 Per manufacturer, if consistent with this Chapter
Office Building	Employee	20

Park (temporary use) Picnic, with showers, flush toilets Picnic, with flush toilets only Recreational vehicle, no water or sewer connections Recreational vehicle, with water and sewer connections Mobile home/Trailer	 Parking space Parking space Vehicle space Vehicle space Space	 40 20 75 100 250
Restaurant/Cafeteria With toilet, add Kitchen waste, add Garbage disposal, add Cocktail lounge, add Kitchen waste disposal service, add	Employee Customer Meal Meal Customer Meal	20 7 6 1 2 2
Restroom, public	Toilet	200
School Staff and office Elementary, add Middle and High, add with gym & showers, add with cafeteria, add Boarding, total flow	 Person Student Student Student Student Person	 20 15 20 5 3 100
Service Station with toilets	First bay Each additional bay	1000 500
Shopping Center, no food or laundry	Square foot of retail space	0.1
Store Public restroom, add	Employee Square foot of retail space	20 0.1
Swimming Pool, Public	Person	10
Theater Indoor Drive-in	 Seat Car space	 5 10

Note: Unit flow rates published in standard texts, literature sources, or relevant area or regional studies are considered by the Department, if appropriate to the project.

Worksheet for Full Flow Capacity of 4-inch @ Min. Slope

Project Description	
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.13	in/ft
Normal Depth	4.0	in
Diameter	4.0	in
Discharge	125,532	gal/day

Results		
Discharge	125,532	gal/day
Normal Depth	4.0	in
Flow Area	0.1	ft²
Wetted Perimeter	1.0	ft
Hydraulic Radius	1.0	in
Top Width	0.00	ft
Critical Depth	3.0	in
Percent Full	100.0	%
Critical Slope	0.15	in/ft
Velocity	2.23	ft/s
Velocity Head	0.08	ft
Specific Energy	0.41	ft
Froude Number	(N/A)	
Maximum Discharge	135,036	gal/day
Discharge Full	125,532	gal/day
Slope Full	0.13	in/ft
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	36.5	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	4.0	in
Critical Depth	3.0	in
Channel Slope	0.13	in/ft
Critical Slope	0.15	in/ft

Worksheet for d/D of 4-inch @ Min. Slope

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Roughness Coefficient	0.013	
Channel Slope	0.13	in/ft
Diameter	4.0	in
Discharge	35,704	gal/day

Results		
Normal Depth	1.5	in
Flow Area	0.0	ft²
Wetted Perimeter	0.4	ft
Hydraulic Radius	0.8	in
Top Width	0.32	ft
Critical Depth	1.6	in
Percent Full	36.5	%
Critical Slope	0.10	in/ft
Velocity	1.92	ft/s
Velocity Head	0.06	ft
Specific Energy	0.18	ft
Froude Number	1.130	
Maximum Discharge	135,036	gal/day
Discharge Full	125,532	gal/day
Slope Full	0.01	in/ft
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.0	in
Length	0.0	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.0	in
Profile Description	N/A	
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.0	%
Normal Depth Over Rise	36.5	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.5	in
Critical Depth	1.6	in
Channel Slope	0.13	in/ft
Critical Slope	0.10	in/ft