

City of Smithville Wastewater Master Plan

August 18, 2020





01 **Project Background**

02 **Wastewater Treatment
Plant**

03 **Collection System**

04 **Pump Stations**

05 **Projected CIP**

06 **Discussion**

Project Background

Purpose

- Improvement needs to meet 10-year development projections
- Long-term “ultimate” collection system plan



Pump Station Performance

Key issues to address:

- Certain Pump Stations at or near capacity.
- Pump stations in need of repair or replacement.



Lakeview Drive Pump Station

Long term goals:

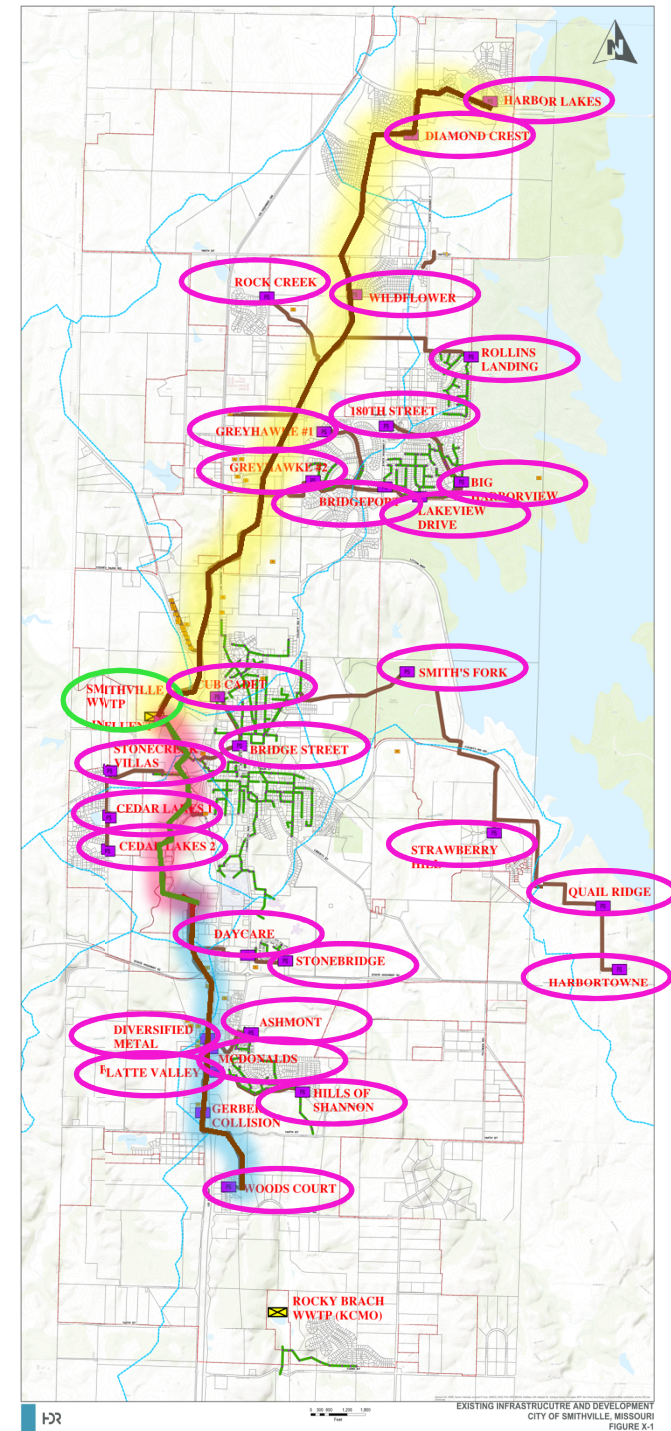
- Eliminate existing pump stations that can be served by gravity
- Minimize need for future pump stations



McDonalds Pump Station

Existing Collection and Conveyance System

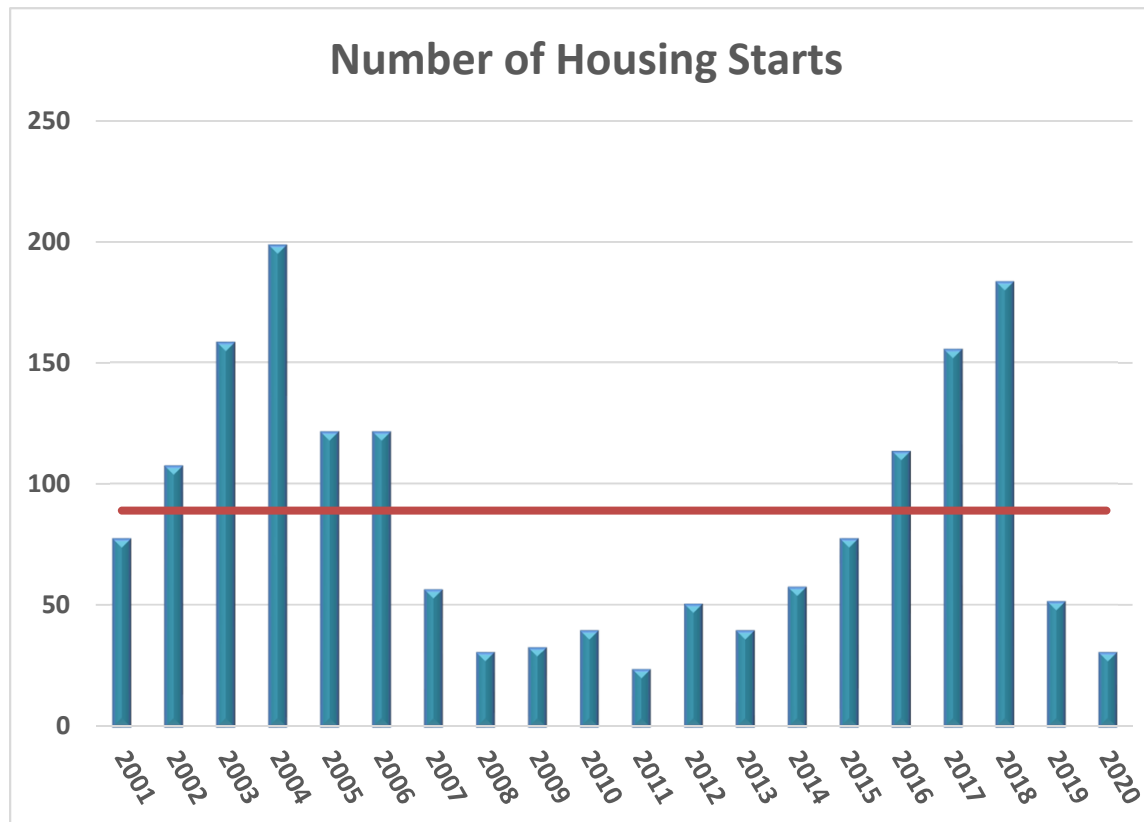
- Smithville WWTP
 - Averaged Daily Flow = 0.70 MGD
 - Peak Daily Flow = 3.7 MGD
 - Capacity = 1.125 MGD
- Primarily served by two force mains:
 - North Force Main
 - South Force Main
 - South Interceptor
- 29 pump stations



Population Projections – Historical Growth

Housing Starts Projection

- Historical average 89 housing starts per year (2001-2019)



$$\frac{89 \text{ residences}}{\text{year}} * \frac{2.7 \text{ persons}}{\text{residence}} = 240 \text{ persons/year}$$

Ten year growth = 2,400 persons

Population Projections – Comprehensive Plan

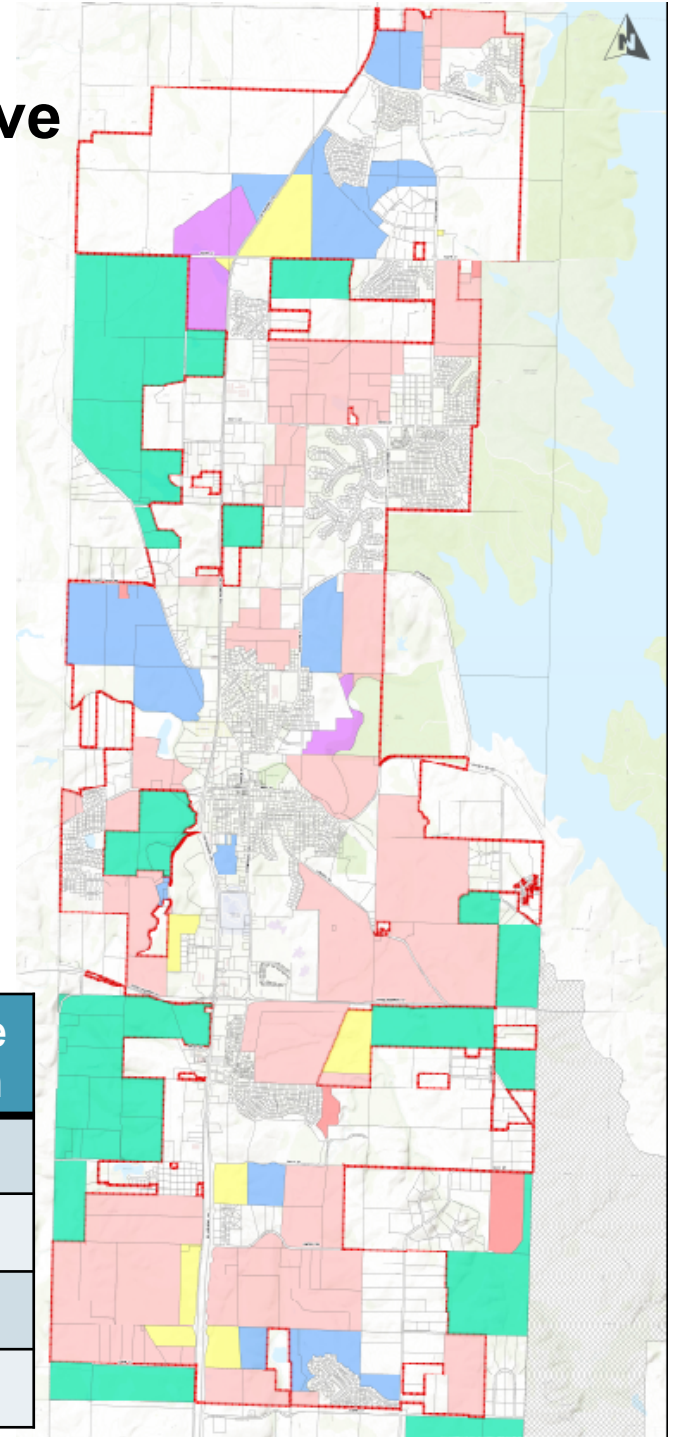
Comprehensive Plan Projection

- Prepared by Stover & Associates, updated July 1, 2020
- Projects population growth of 3,500 – 4,500 new residents within next 10 years

Assumed Population Projection

- Based on information provided during meeting with City on May 20, 2020
- Based on typical population density and current zoning
- Based on short term annexation proposed by City

PROJECTED POPULATION PROJECTIONS	Est. Population Growth	Cumulative Population
Estimated 2020 Population	--	10,764
0-10 Year Growth	4,472	15,236
Ultimate Growth (within current City Limits)	50,278	65,514
Ultimate Growth (outside current City Limits)	12,659	78,173



Smithville Wastewater Treatment Plant

Wastewater Treatment Plant

■ Facilities:

- Influent Pump Station
- Headworks
- Three SBR Basins
- UV disinfection
- Effluent pumping
- Two sludge digester basins
- Excess flow holding tank



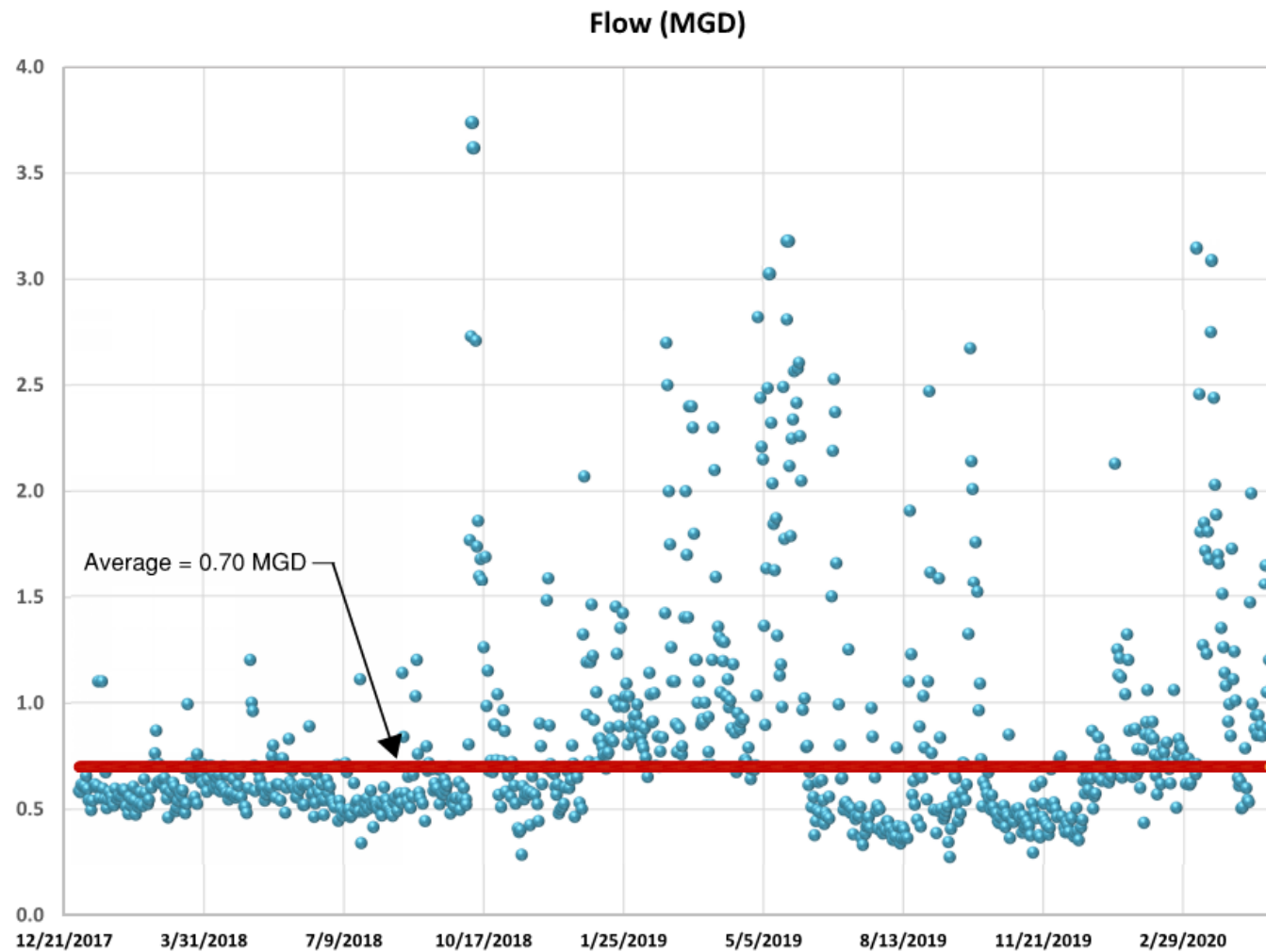
Hydraulic Capacity of Existing WWTP Components

Component	Hydraulic Capacity (MGD)
Influent Pump Station	
Dry Weather Pumps	4.0
Wet Weather Pumps	5.0
Headworks	
Bar Screen	6.0
Sequencing Batch Reactors (SBRs)	
Average Daily Flow, each basin	0.375
Peak Instantaneous Flow, 3 basins	1.315
Total Average Daily Flow, 3 basins	1.125
Total Peak Instantaneous Flow, 3 basins	3.950
UV Disinfection	6.0
Effluent Pumping	7.9
Excess Flow Holding Tank (1.2 MG)	5.0

Current MDNR Permitted Effluent Limits

Parameter	Daily Maximum	Weekly Average	Monthly Average
Outfall #001			
BOD5 (mg/L)	-	45	30
TSS (mg/L)	-	45	30
Ammonia (Nov 1 – April 30) (mg/L)	11.5	-	3.2
Ammonia (May1 – Oct 31) (mg/L)	12.4	-	5.6
Oil and Grease (mg/L)	15	-	10
Fecal Coliform (#/100ml)	-	1,030	206

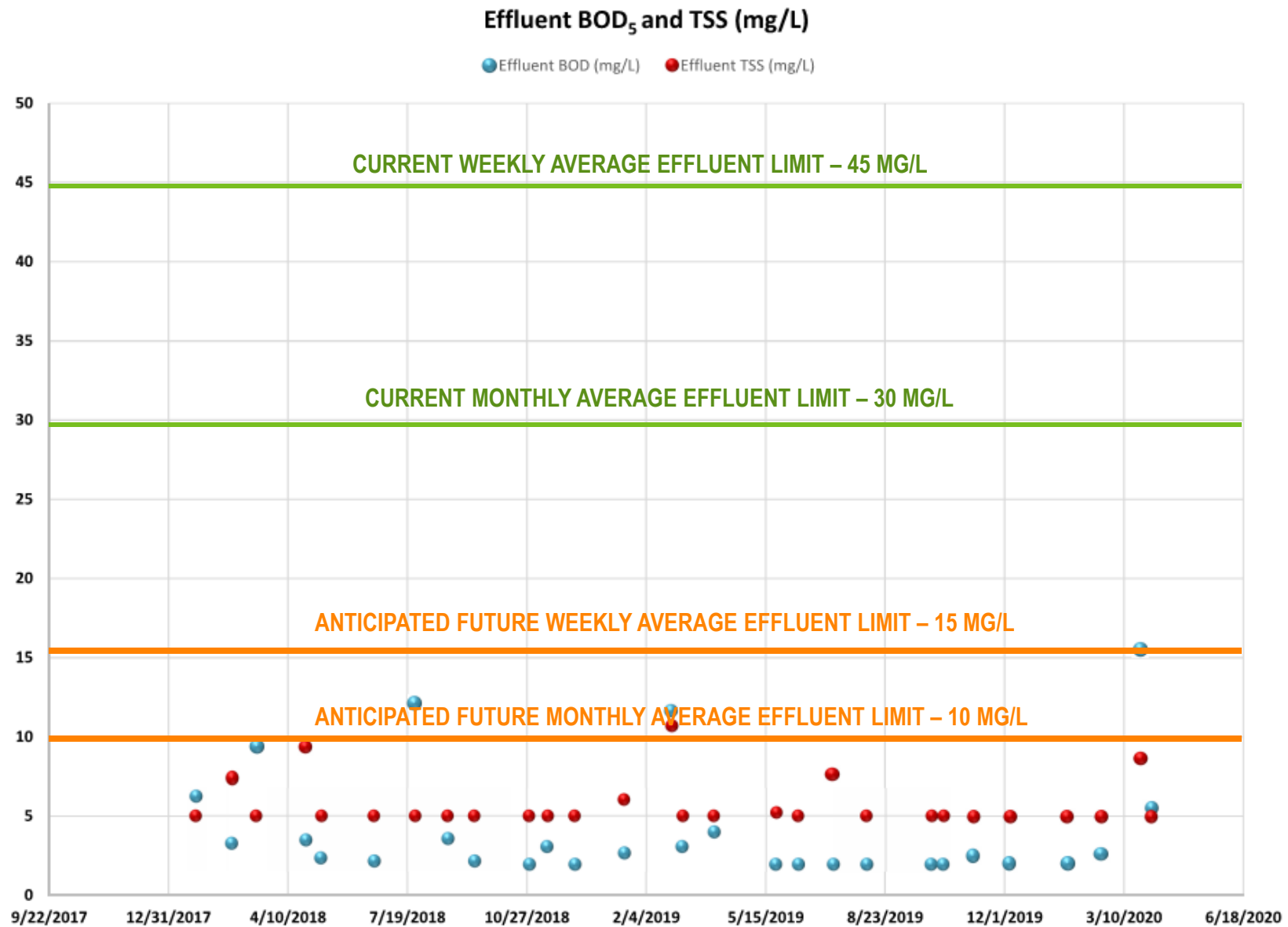
Wastewater Treatment Plant Existing Performance



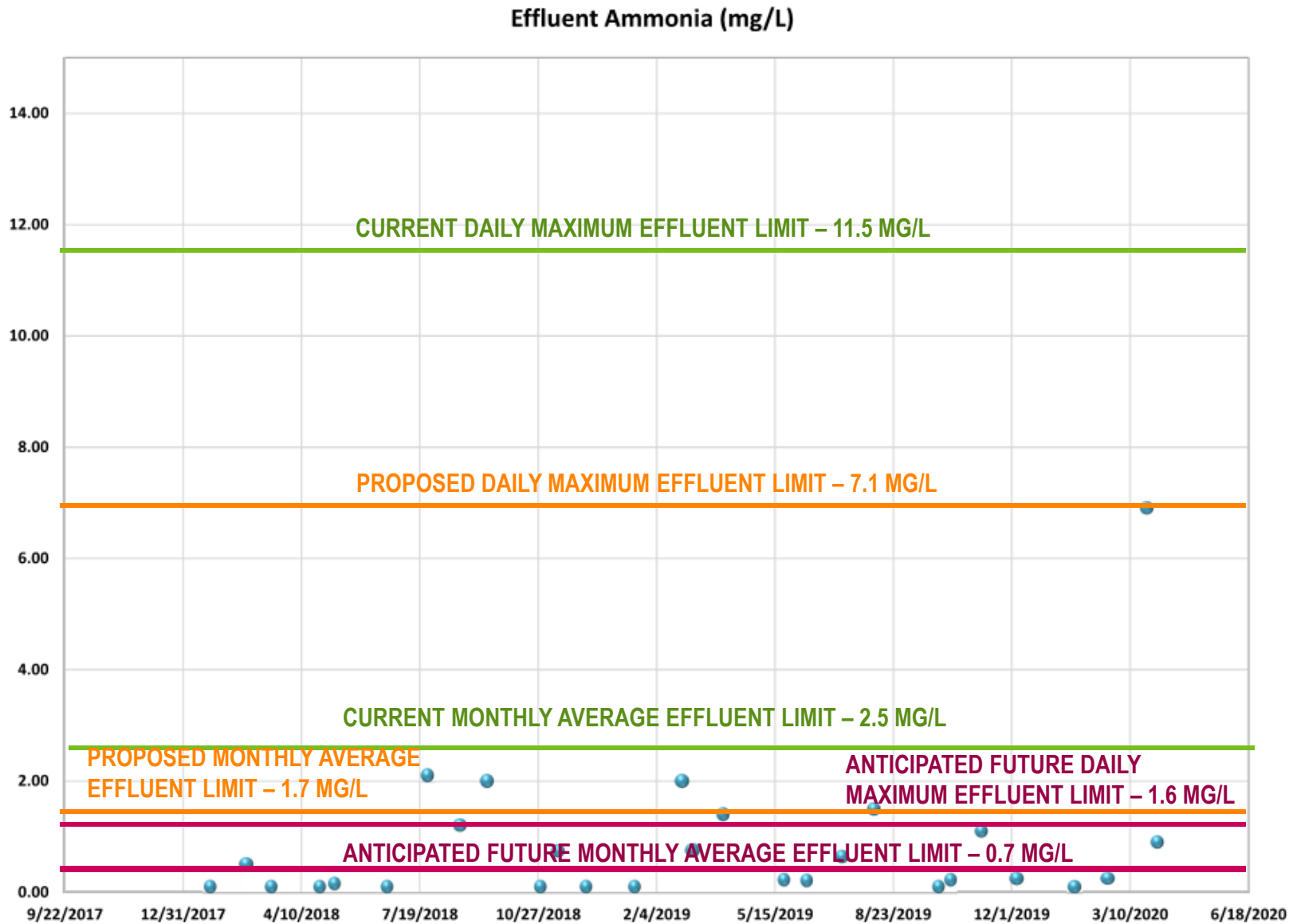
*Data from Daily Monitoring Reports (DMRs) from January 2018 to May 2020

- **Average Daily Flow = 0.70 MGD**
- **Peak Daily Flow = 3.7 MGD**

WWTP Performance – BOD₅ and TSS



WWTP Performance

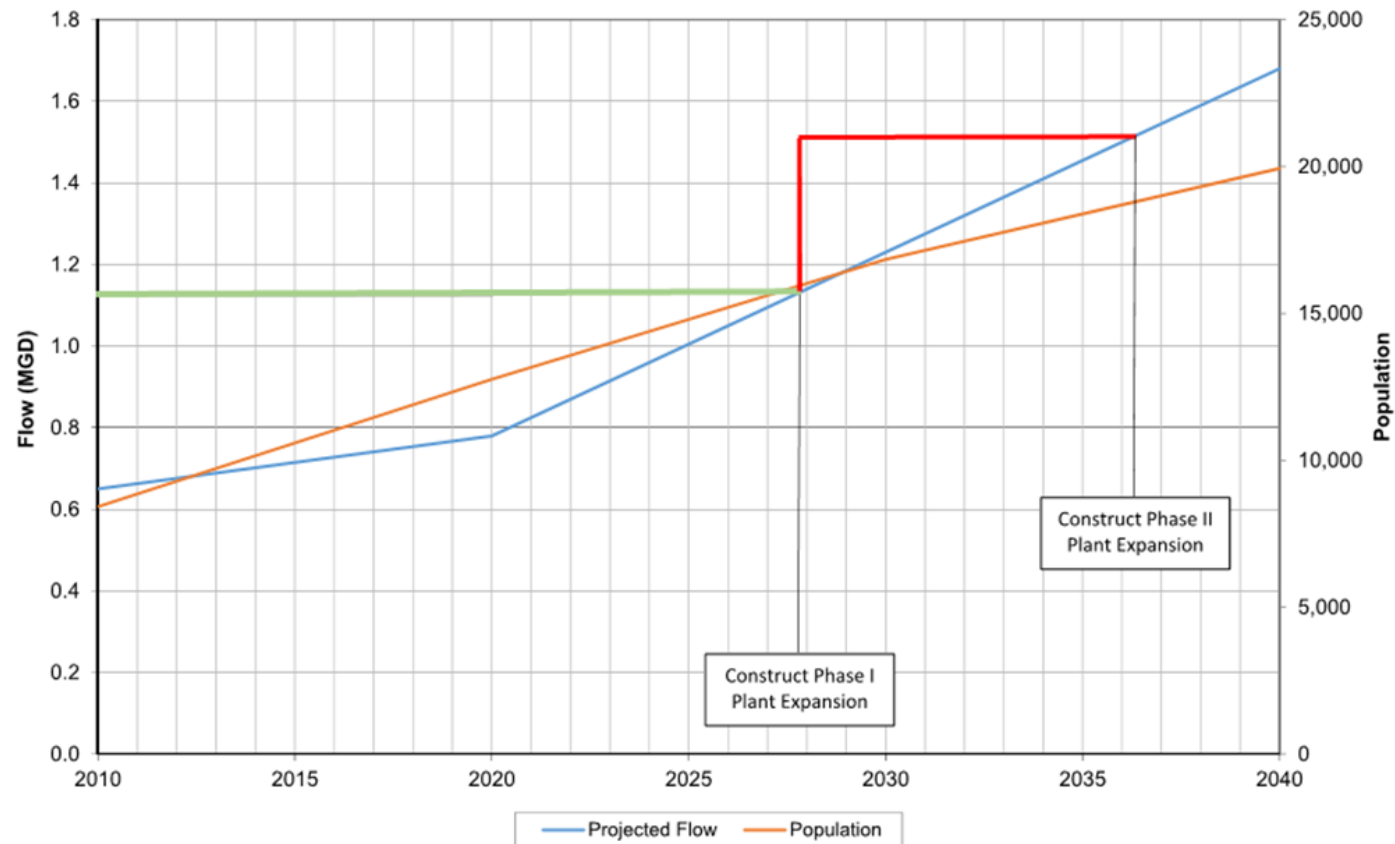


Wastewater Treatment Plant

Capacity Expansion Plan

- Phase I – 0.375 MGD Expansion, 1.5 MGD Total Plant Capacity
- Phase II – 0.375 MGD Expansion, 2.25 MGD Total Plant Capacity

Facility Phasing Using Future Development



Wastewater Treatment Plant

Phase 1	Total Cost
Liquids Improvements	\$2,260,000
Solids Improvements	\$1,781,000

Phase I Improvements

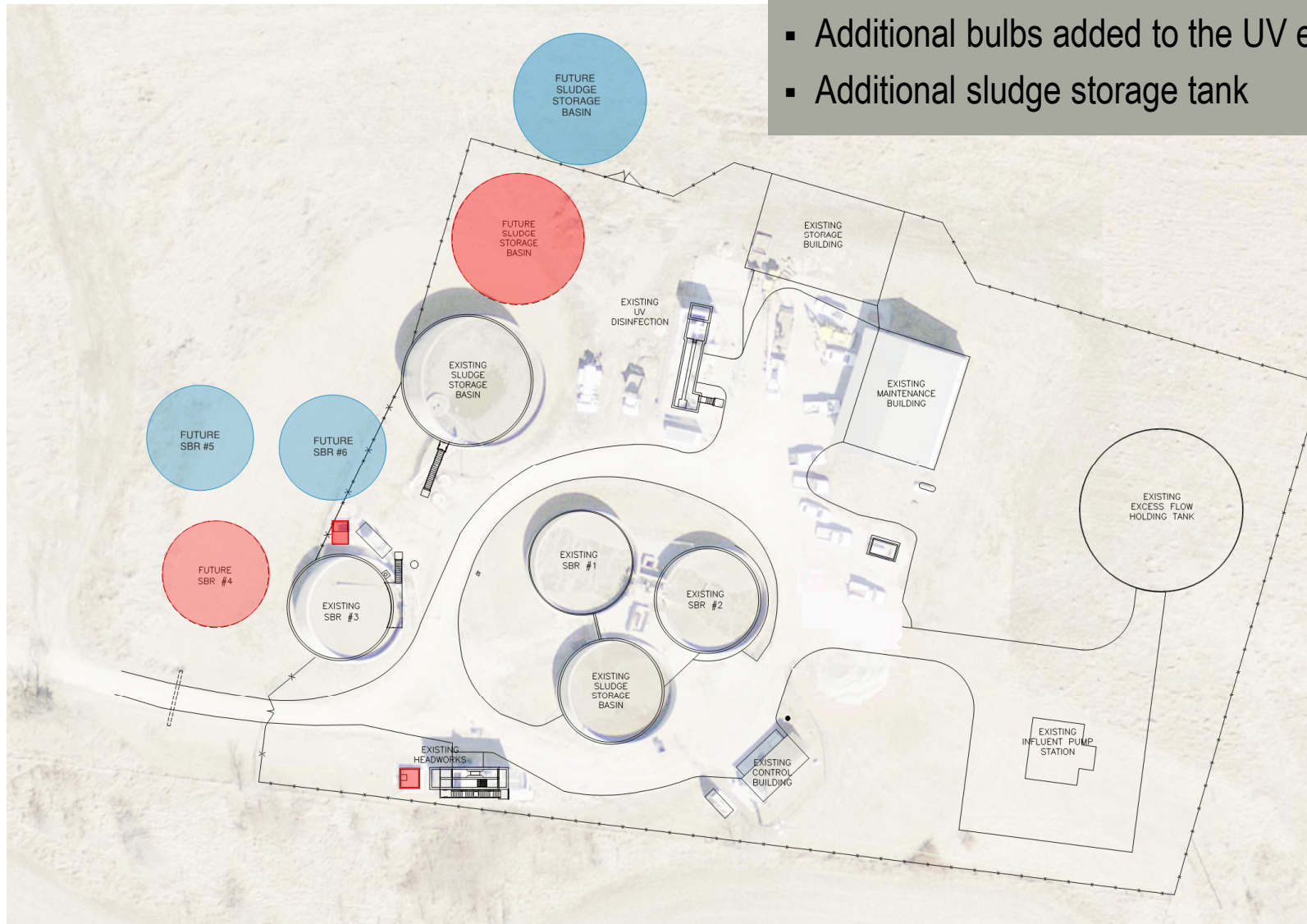
- Construct a fourth SBR basin
- Upgrades to influent valve vault
- Upgrades to effluent valve vault
- Additional sludge storage tank



Wastewater Treatment Plant

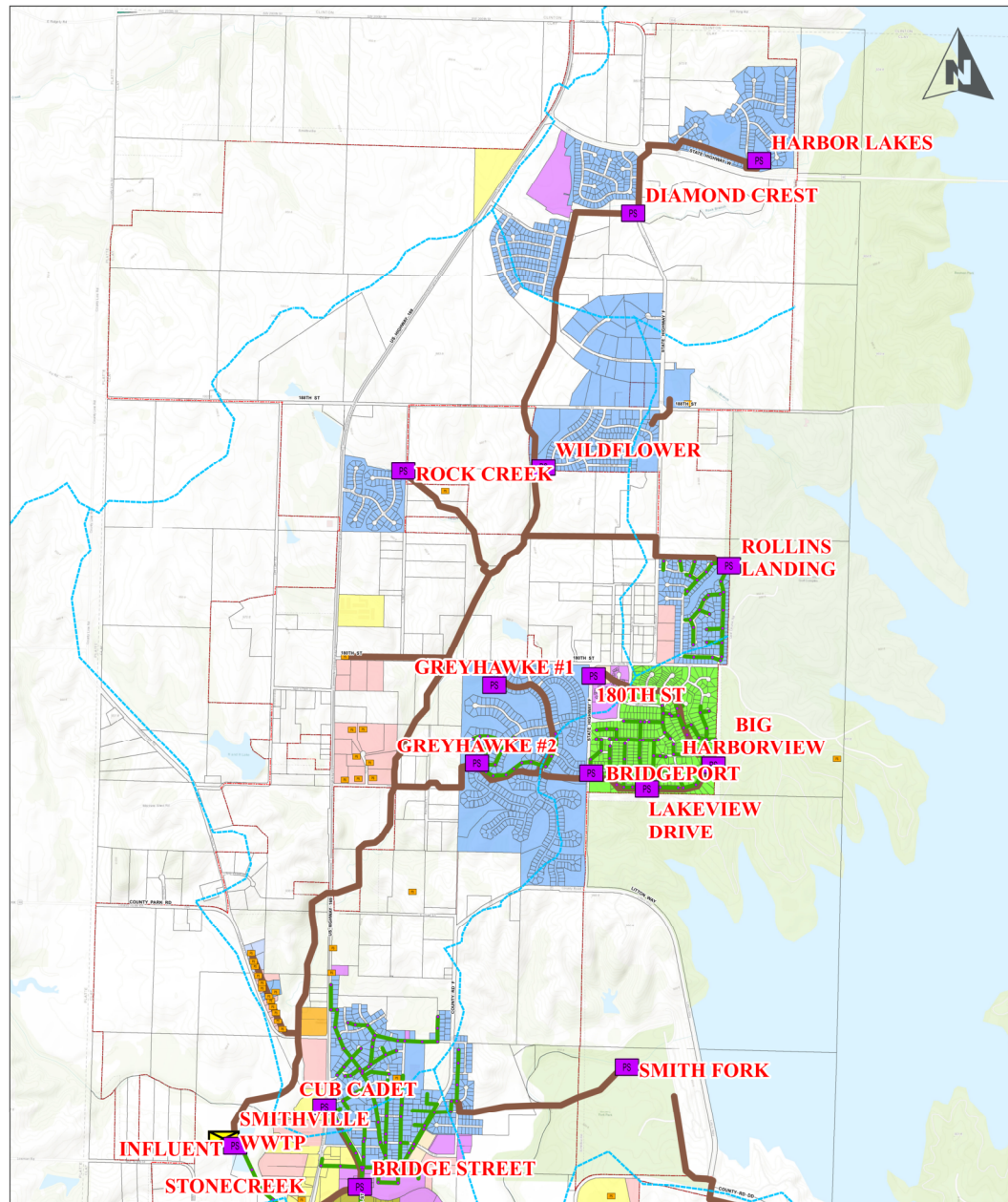
Phase II Improvements

- Addition of a fifth and sixth SBR basin
- Upgrades to influent valve vault
- Upgrades to effluent valve vault
- Additional bulbs added to the UV equipment
- Additional sludge storage tank

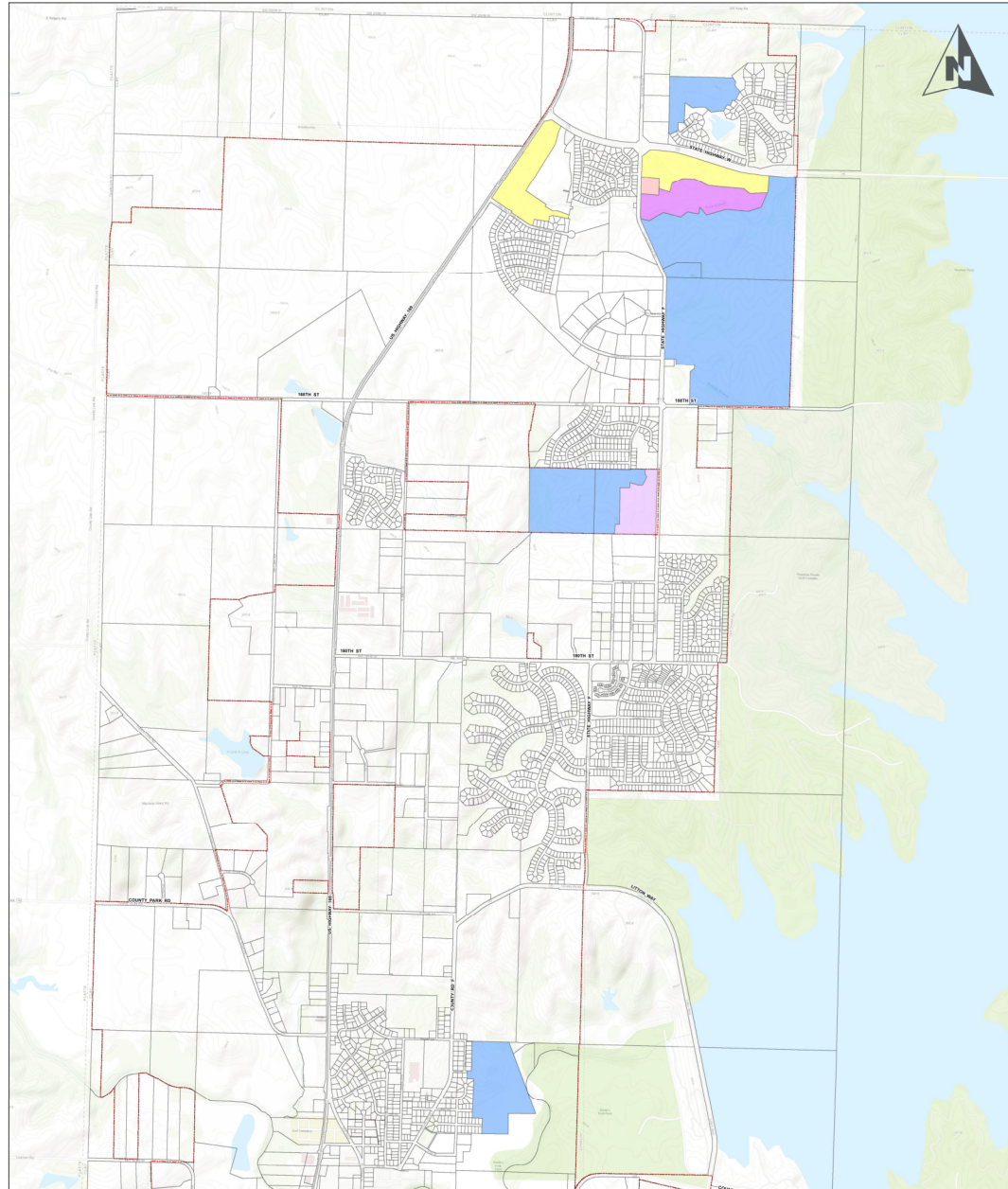


Collection System

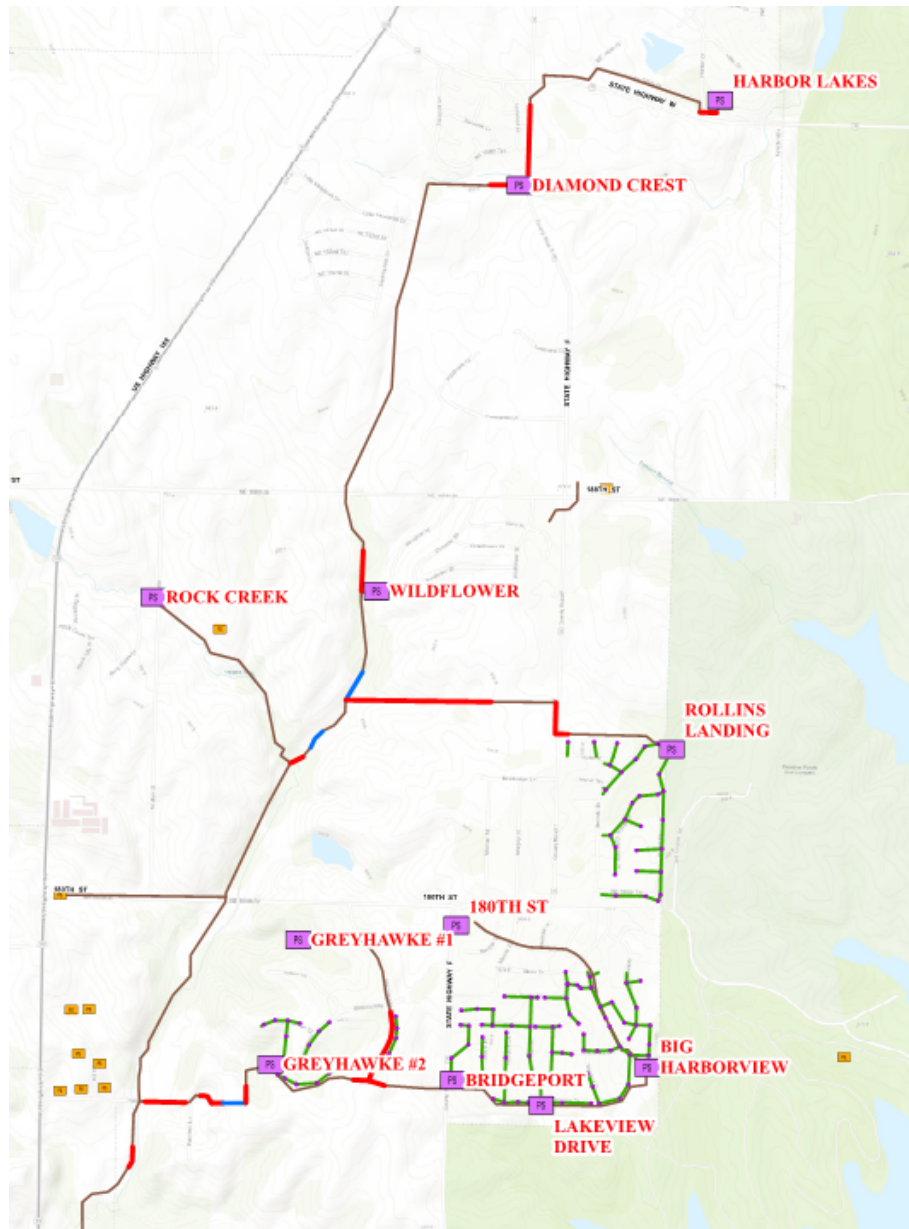
Existing Infrastructure - North



10-Year Development - North



Existing Infrastructure Performance - North



Model run to simulate 10
Year flow rates on existing
infrastructure.

Existing Infrastructure Capacity – North Force Main

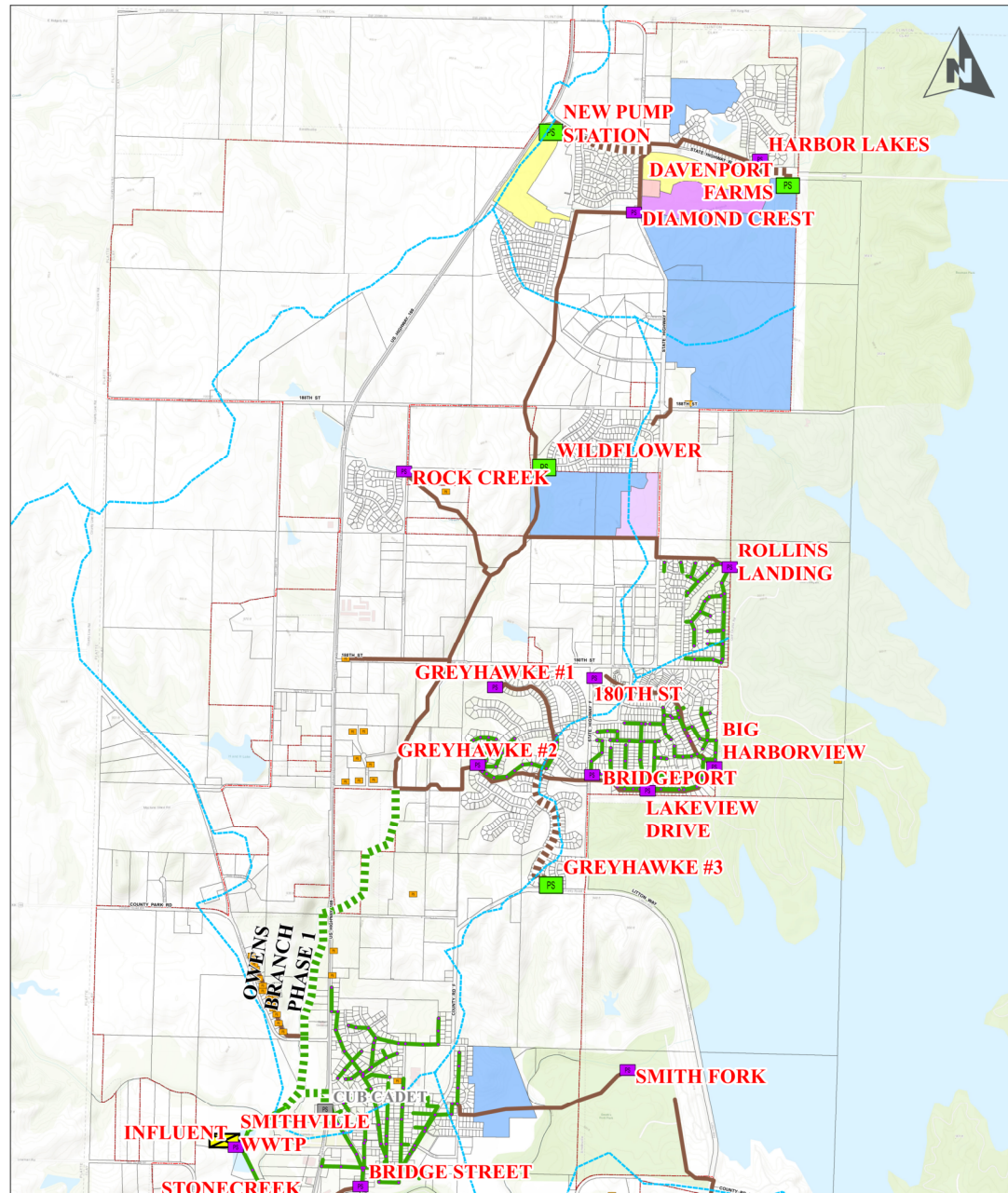
NORTH SMITHVILLE SHORT TERM DEVELOPMENT CAPACITY	Single Family Houses	Estimated Additional Population
Additional Development Capacity (no improvements)	265	716
Additional Development Capacity with Wildflower Pump Station improvements (Eagle Heights development responsibility)	320*	864
Total Existing North Force Main Capacity	585	1,580

*230 houses from Eagle Heights plus 90 additional houses from development to the north

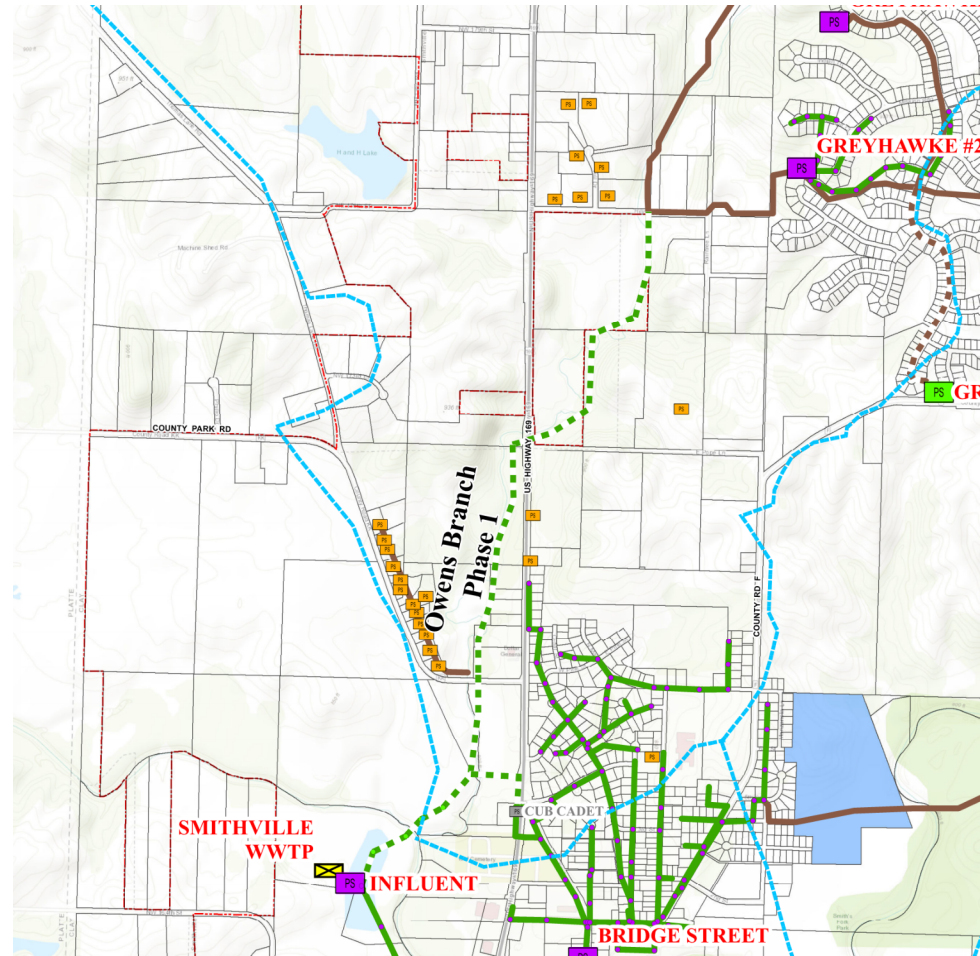
- *City should begin to plan for future capacity upgrades in the next two to three years*
- *Allow time for design, easement acquisition, and construction*



10-Year Recommended Improvements - North

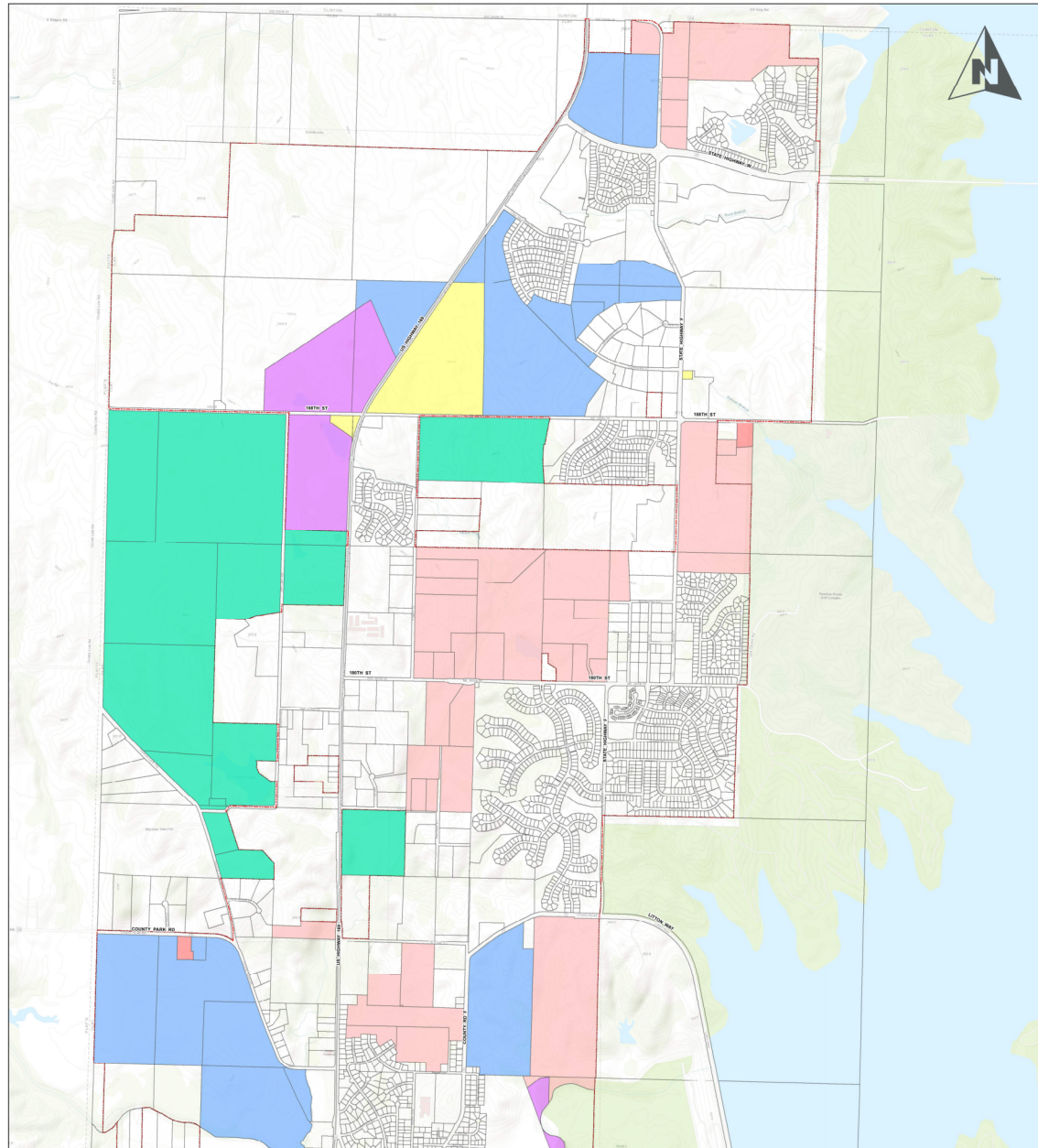


10-Year Recommended Improvements - North

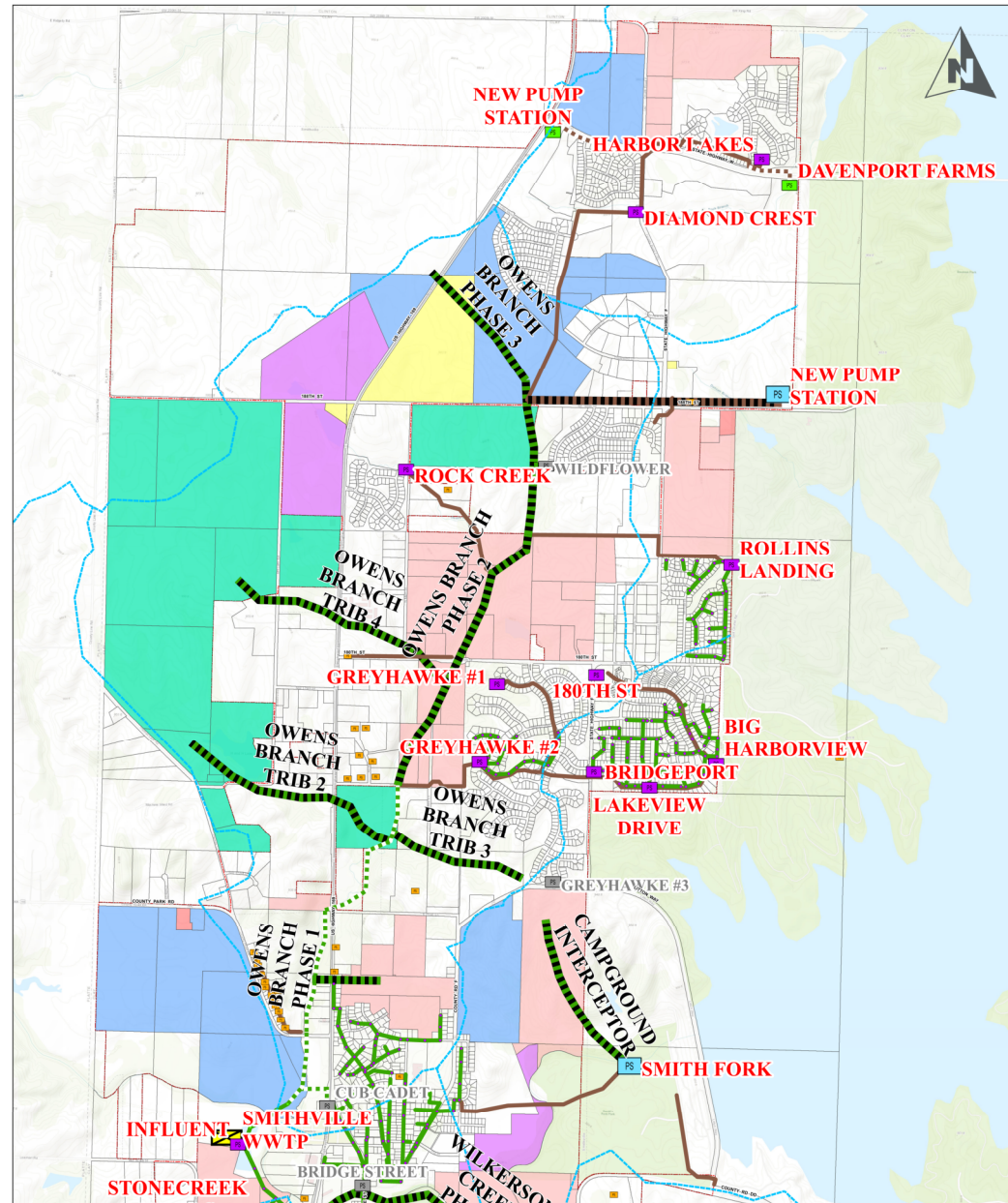


Interceptor	Pipe Length (Ft.)	Pipe Size (In.)	Total Cost
Owens Branch – Phase 1	9,157	30	\$6,517,000

Ultimate Development - North



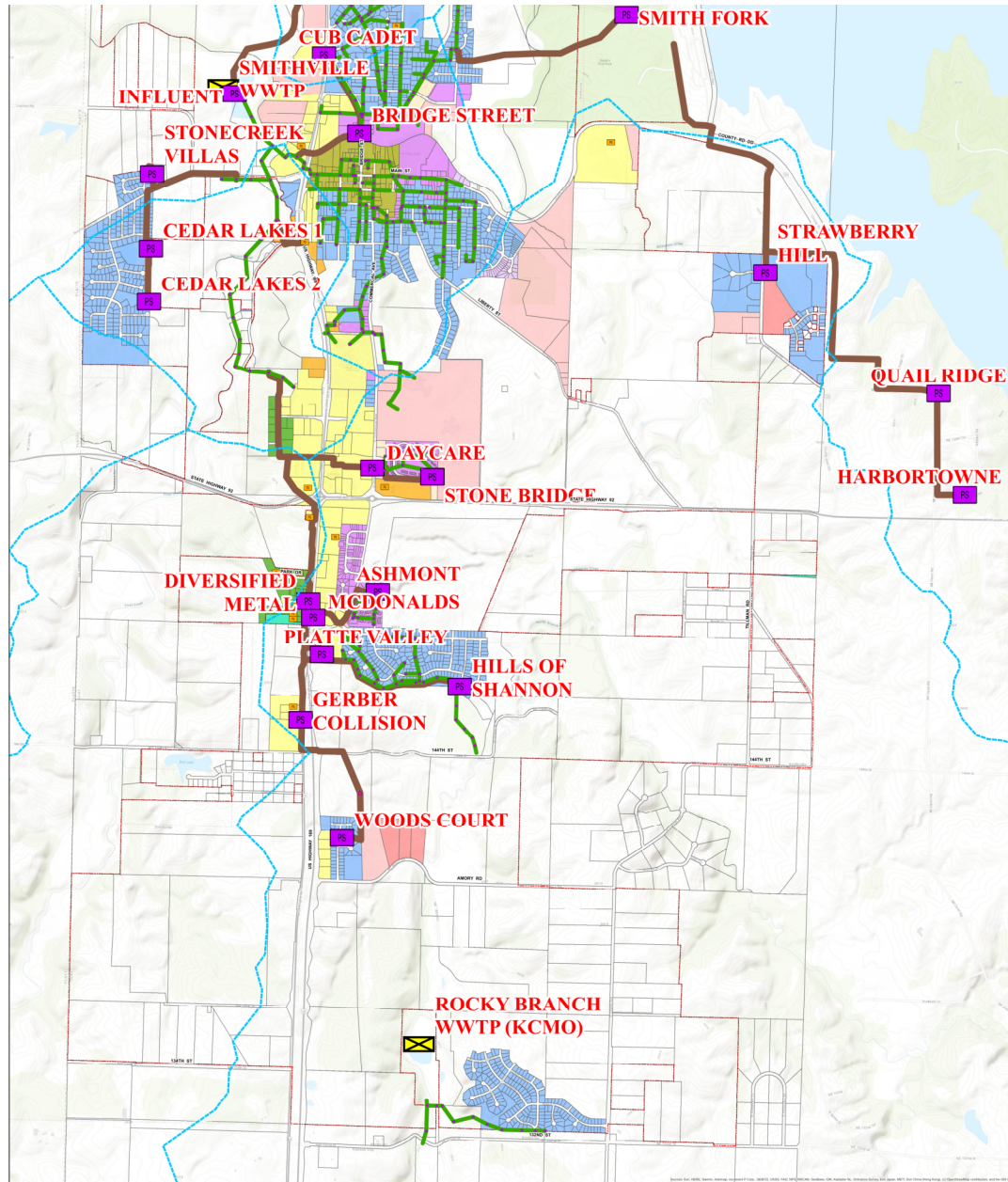
Ultimate Recommended Improvements - North



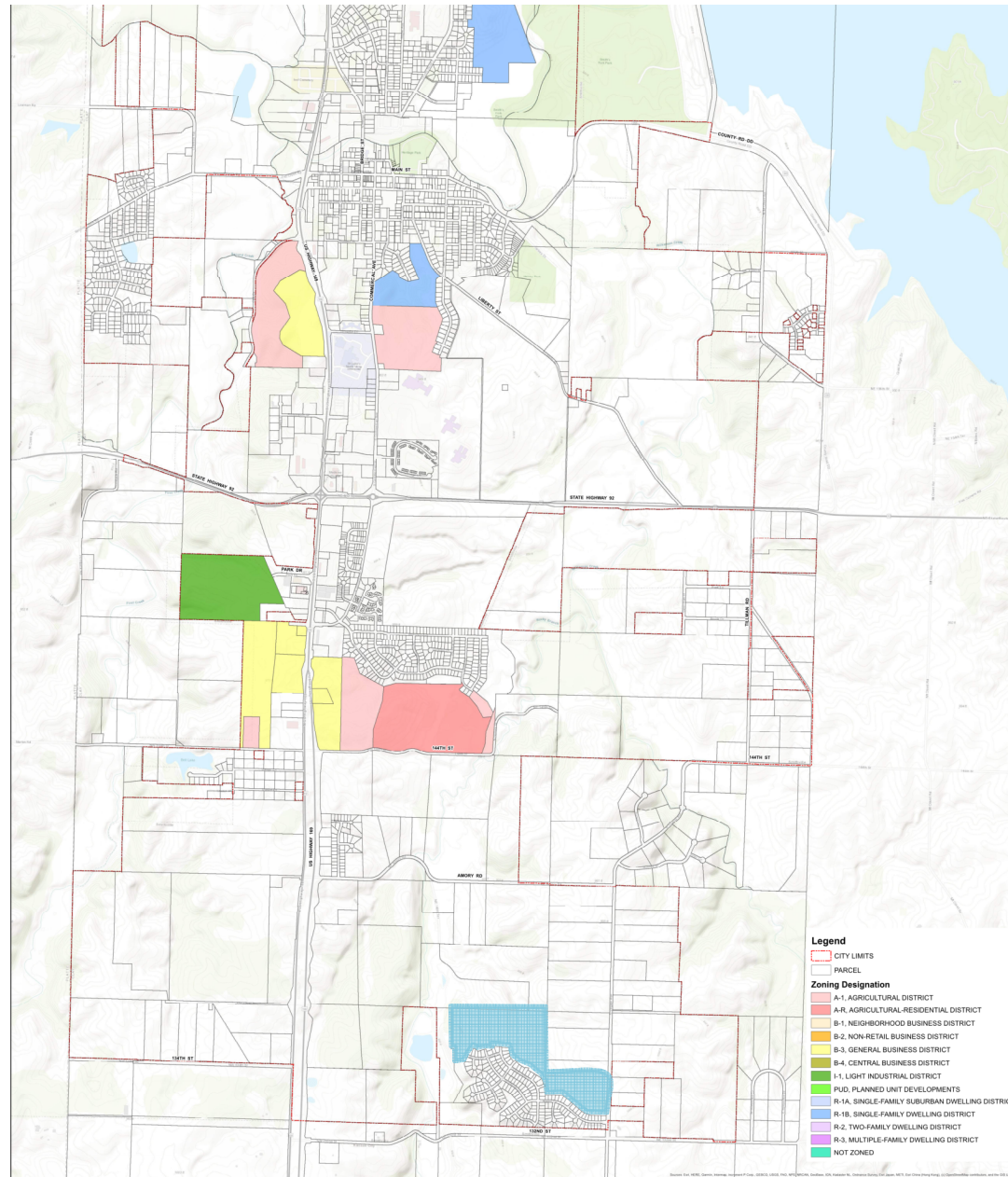
Ultimate Recommended Improvements - North

Interceptor	Pipe Length (Ft.)	Pipe Size (In.)	Total Cost
Owens Branch Phase 2	9,075	18	\$3,342,700
Owens Branch Phase 3	3,478	8	\$826,000
SUBTOTAL:			\$4,168,700
Owens Branch Tributary 1	1,249	8	\$297,500
Owens Branch Tributary 2	4,950	10	\$1,471,300
Owens Branch Tributary 3	2,884	8	\$683,900
SUBTOTAL:			\$2,452,700
TOTAL:			\$6,621,400

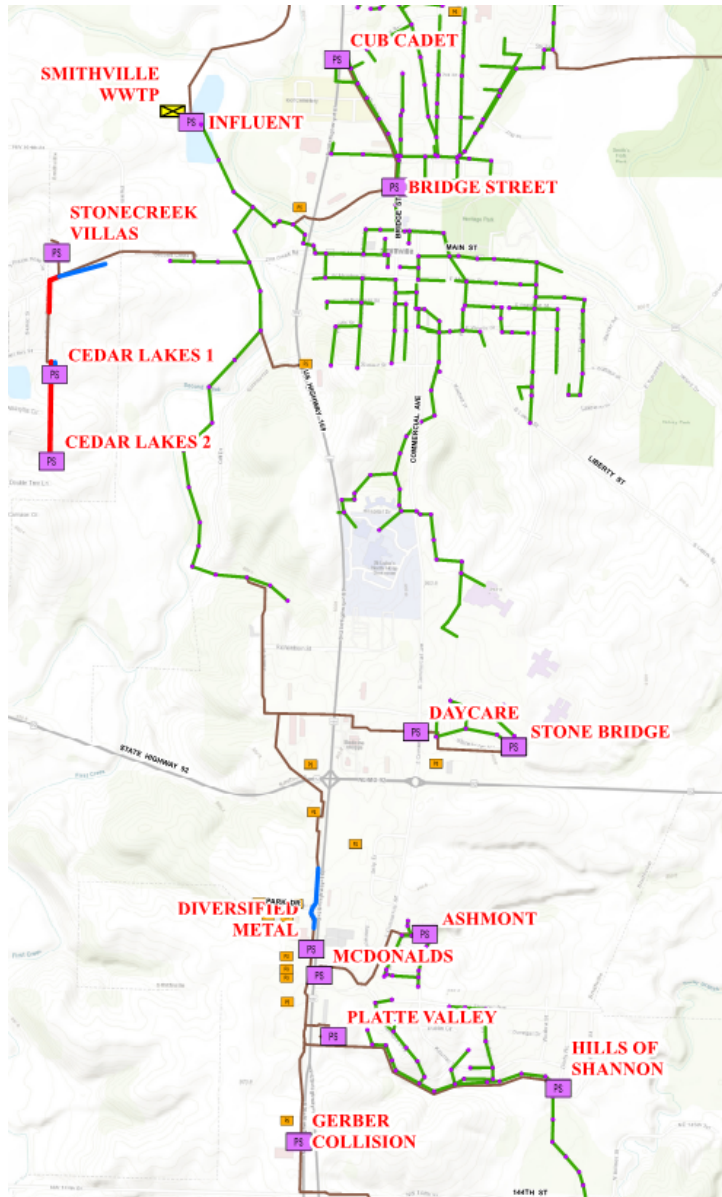
Existing Infrastructure - South



10-Year Development - South



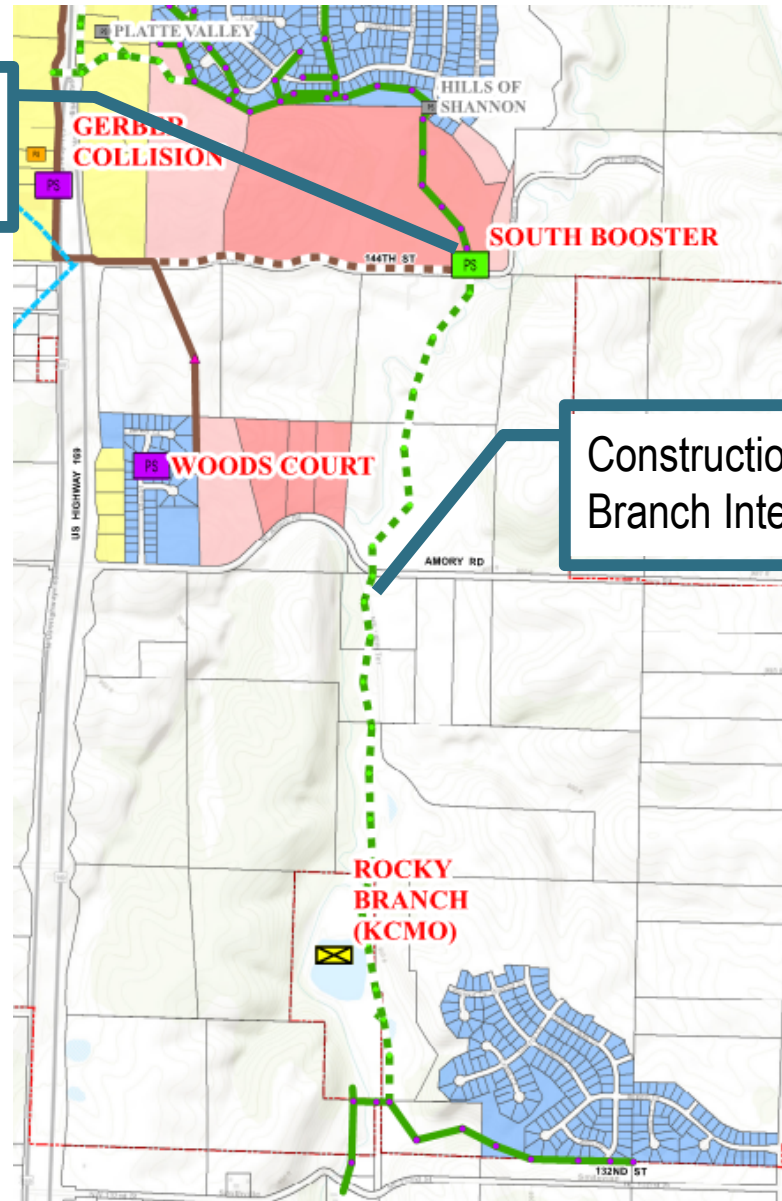
Existing Infrastructure Performance - South



Model run to simulate **10 Year** flow rates on existing infrastructure.

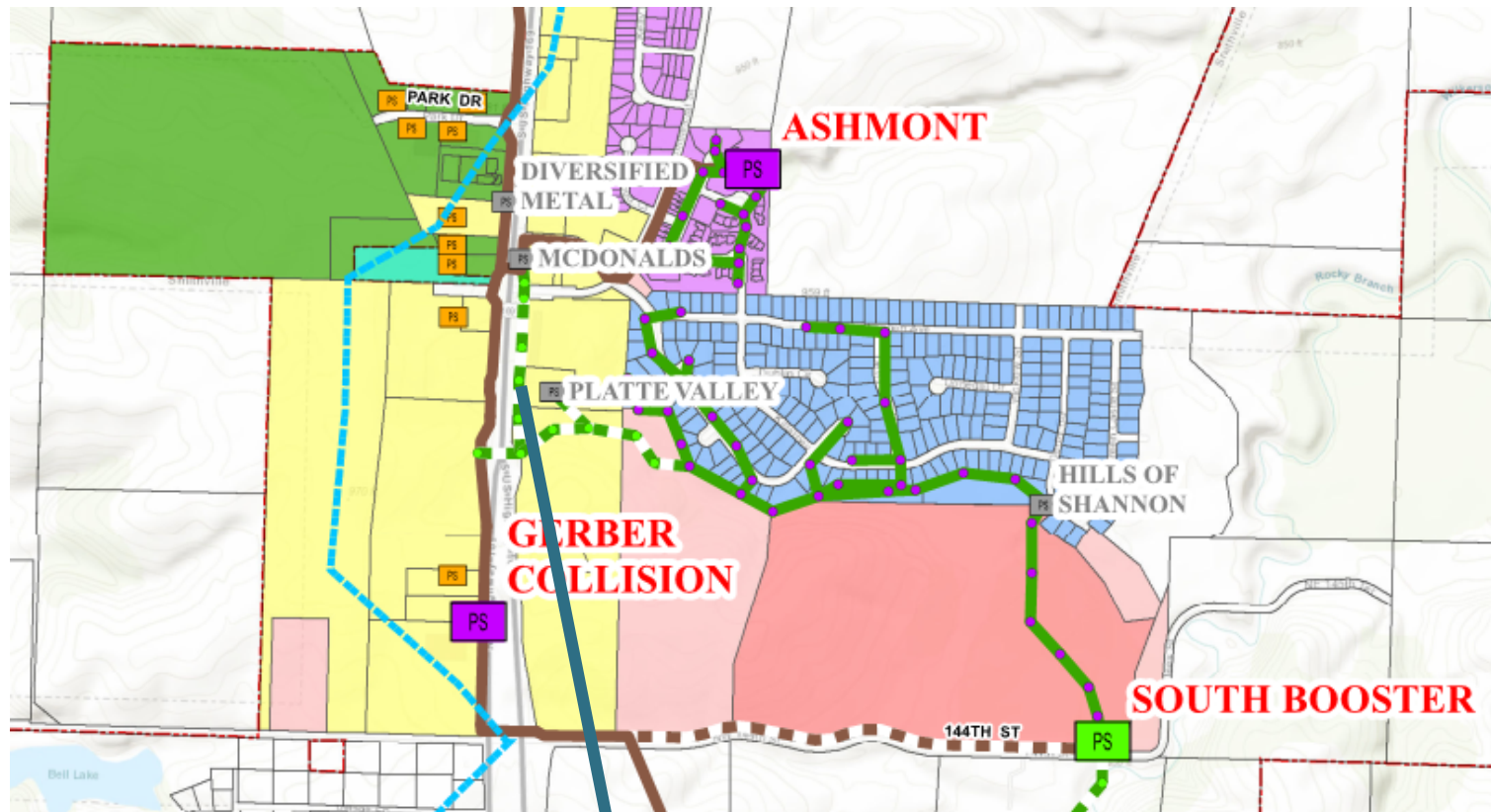
Short-term Planned Infrastructure - South

South Booster Pump Station
and associated force main tie-in



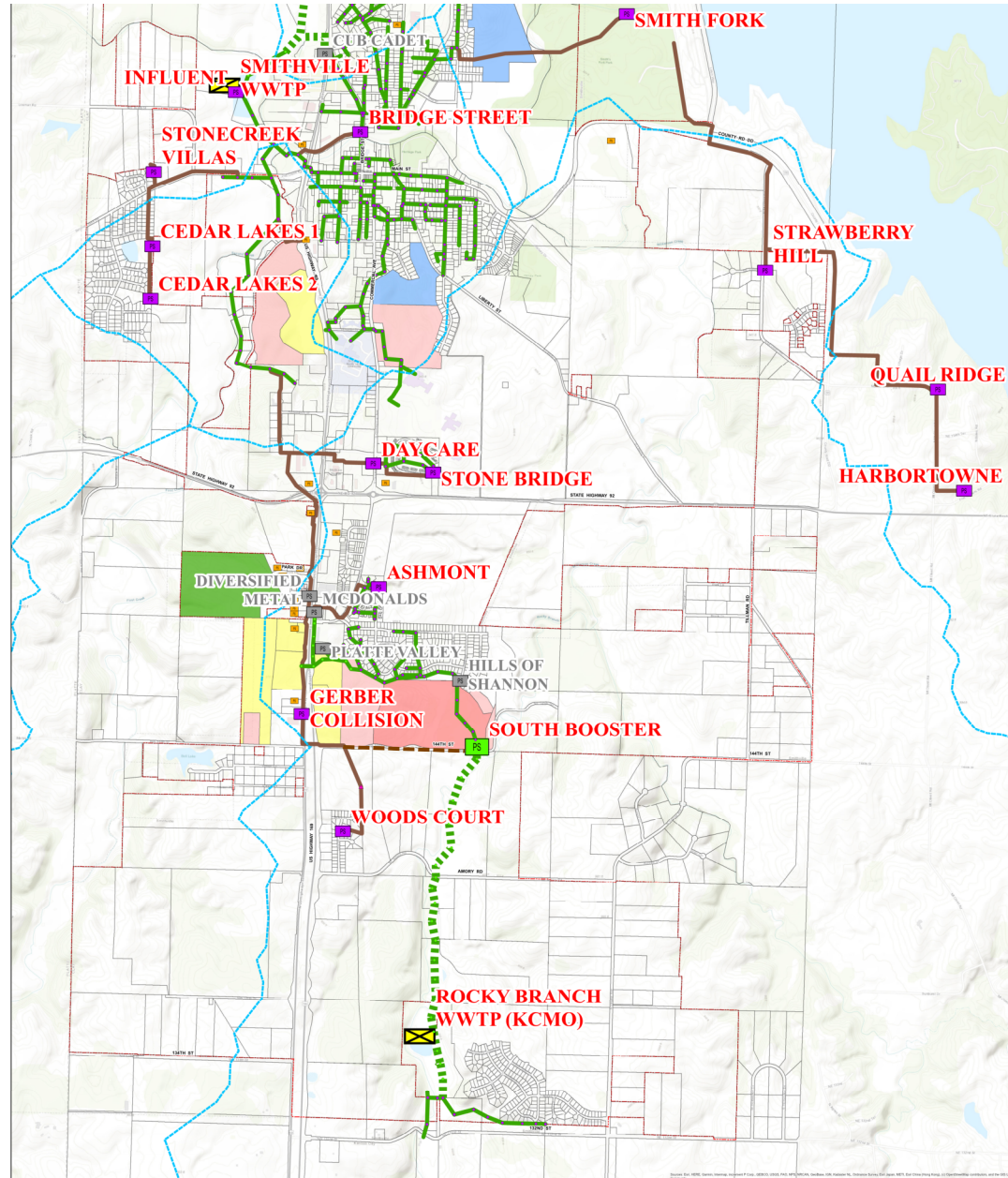
Construction of Rocky
Branch Interceptor

Short-term Planned Infrastructure - South

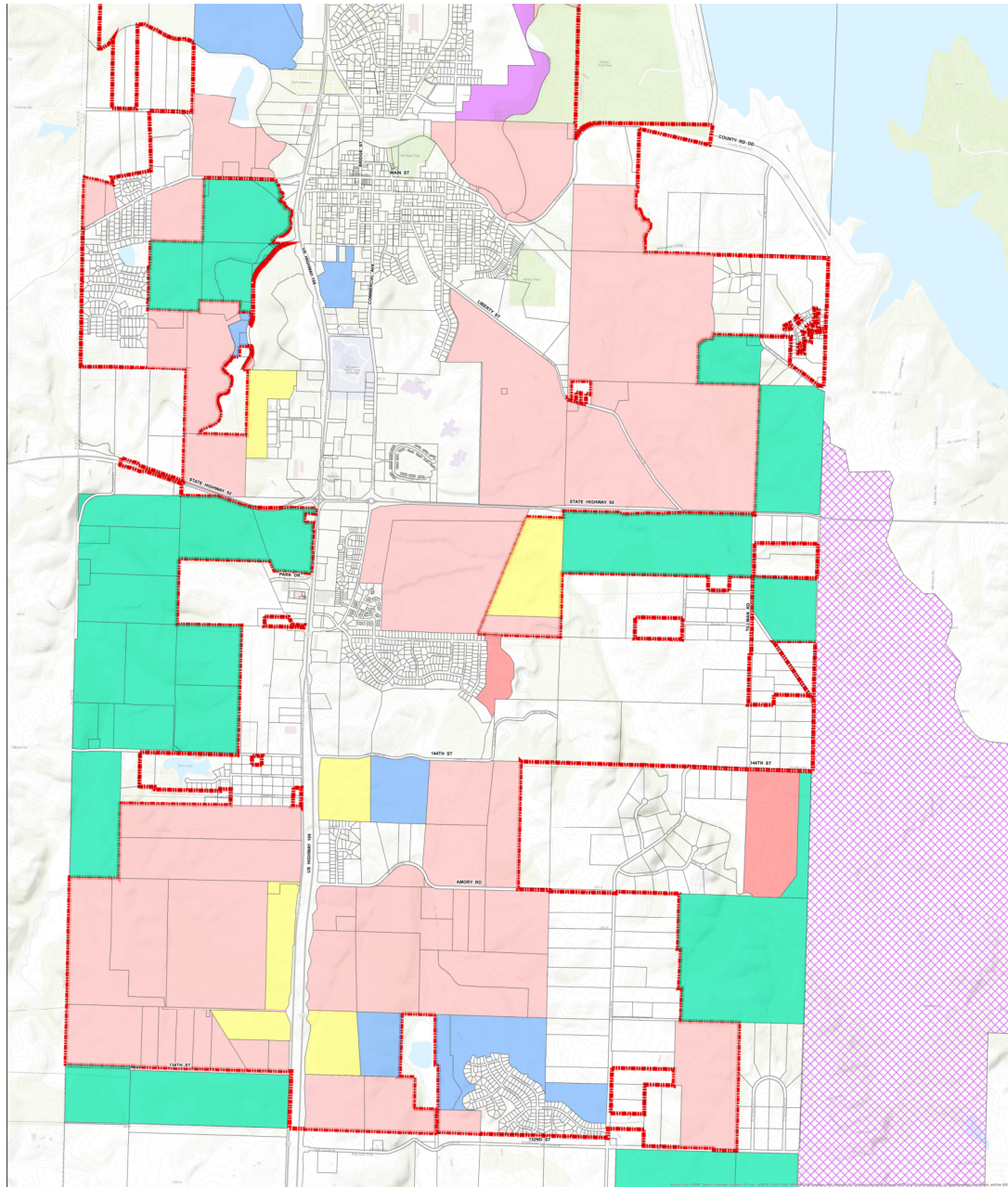


Conversion from existing pump stations to gravity collection

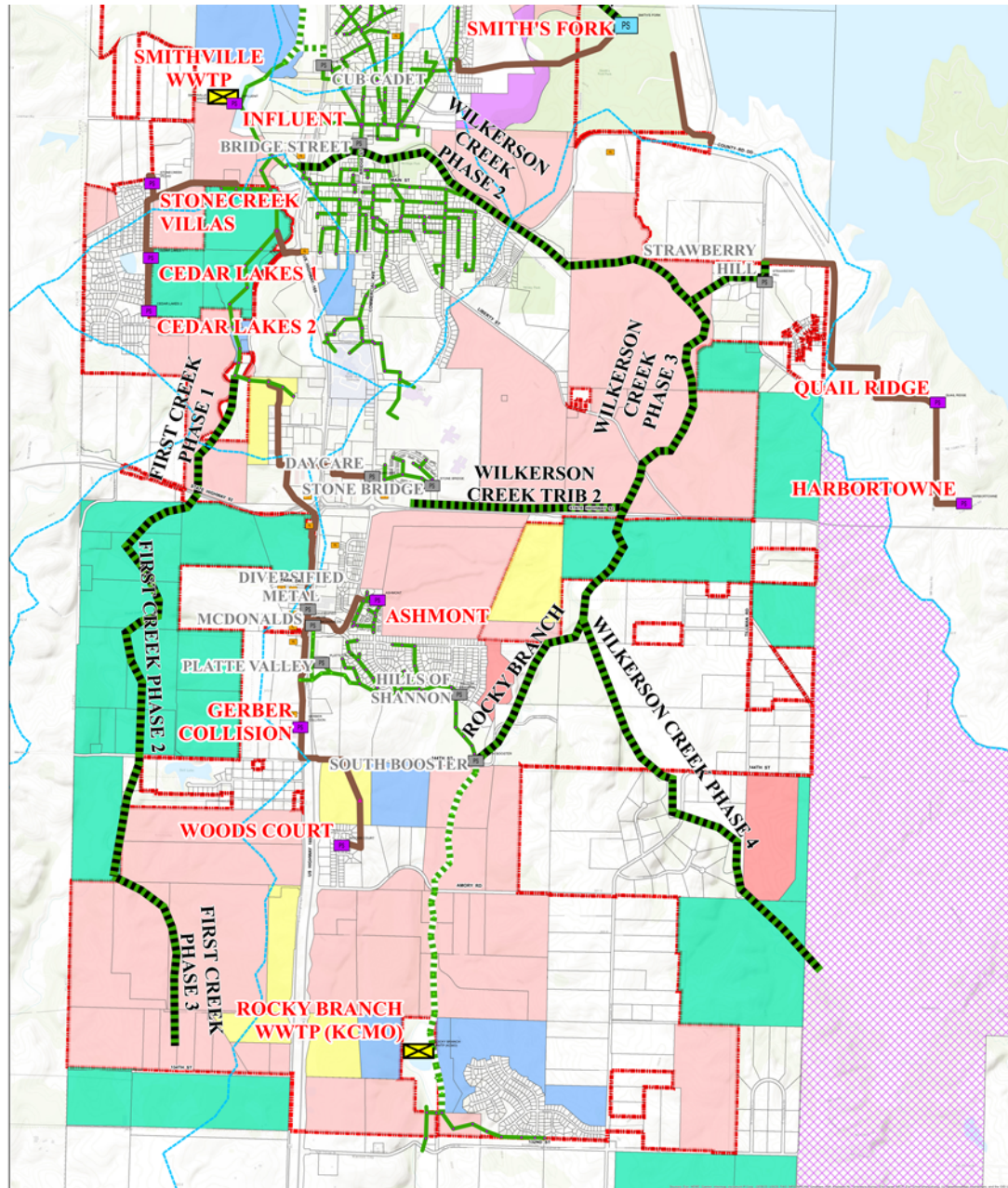
10-Year Recommended Improvements - South



Ultimate Development - South



Ultimate Recommended Improvements - South



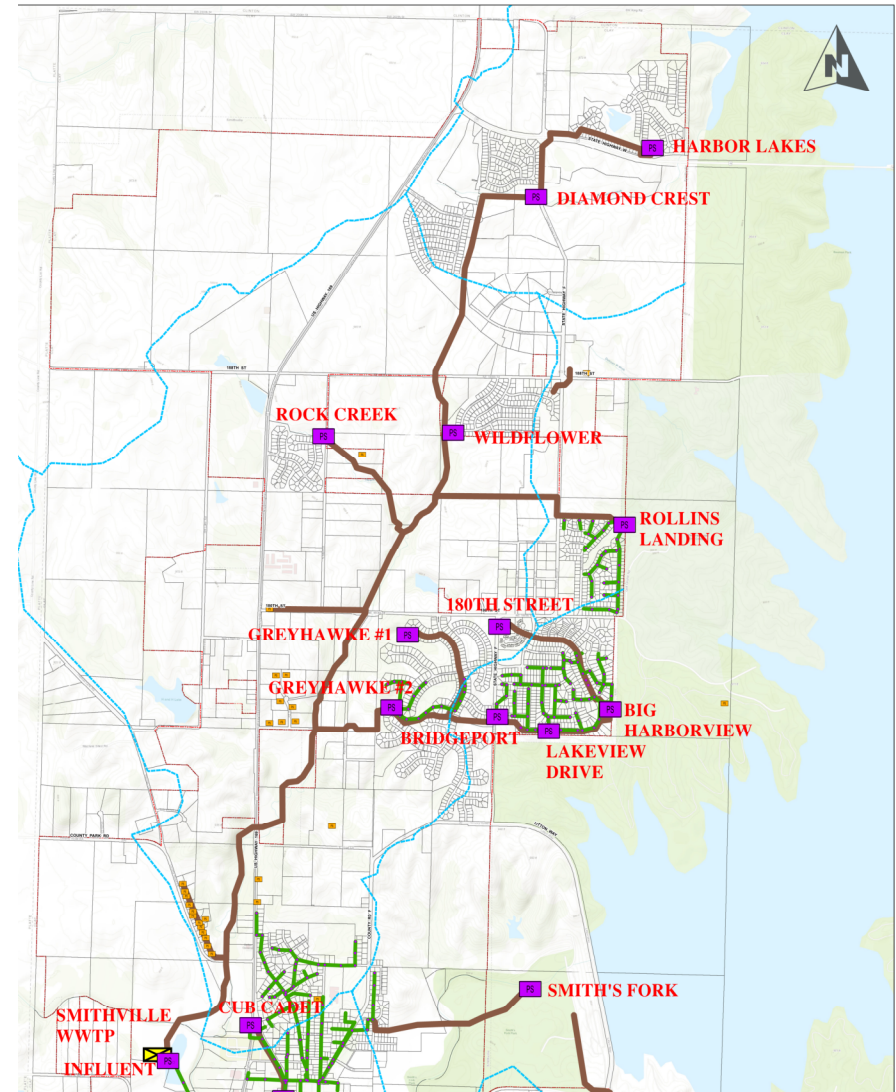
Ultimate Recommended Improvements - South

Interceptor	Pipe Length (Ft.)	Pipe Size (In.)	Total Cost
Wilkerson Creek Phase 1	1,373	36	\$1,115,400
Wilkerson Creek Phase 2	8,109	36	\$6,542,300
Wilkerson Creek Phase 3	6,580	27 - 30	\$4,315,700
Wilkerson Creek Phase 4	10,839	21	\$4,628,800
Rocky Branch Segment 1	5,938	21	\$2,539,100
SUBTOTAL:			\$14,512,000
Wilkerson Creek Tributary 1	1,638	8	\$390,500
Wilkerson Creek Tributary 2	3,686	10	\$1,092,700
SUBTOTAL:			\$1,483,200
First Creek Segment 1	2,279	21	\$974,200
First Creek Segment 2	6,317	18	\$2,327,300
First Creek Segment 3	9,075	10 - 18	\$2,167,300
SUBTOTAL:			\$5,468,800
TOTAL:			\$21,464,000

Pump Stations

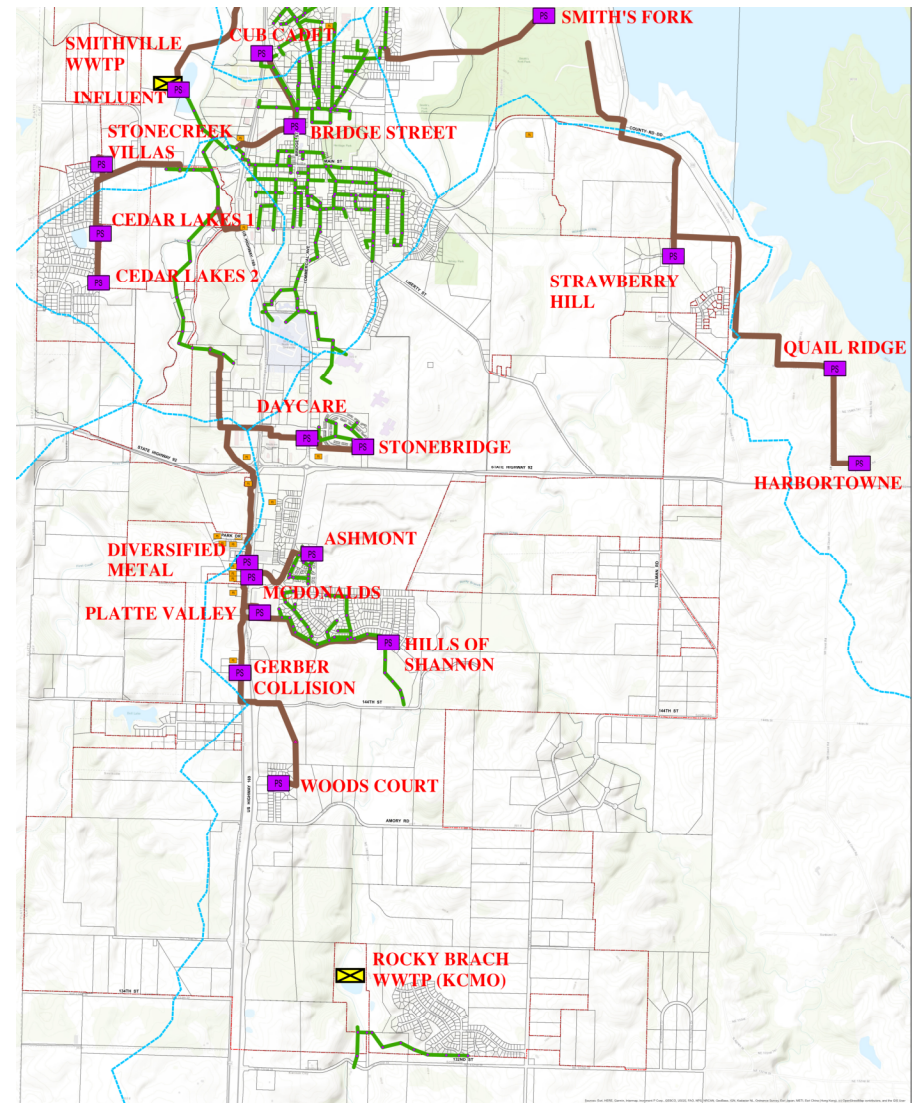
Pump Station Condition Assessment - North

Pump Stations	Rehabilitation	Estimated Cost
Harbor Lakes	Controls, Fencing, Site Lighting	\$17,000
Diamond Crest	Access Road	\$10,000
Wildflower	Capacity	1
Rock Creek	Fencing	\$5,000
Rollins Landing	Access Road, Fencing	\$15,000
Greyhawke #1	Access Road	\$10,000
Greyhawke #2	Access Road	\$10,000
180 th Street	Access Road, Fencing	\$15,000
Lakeview Drive	Fencing	\$5,000
Bridgeport	Controls, Access Road, Fencing	\$25,000
Big Harborview	Fencing	\$5,000
Smith's Fork	Located in Floodplain	1
Cub Cadet		2
Bridge Street	Structural, Fencing	\$10,000
Subtotal		\$127,000
Contingency	25%	\$31,750
Total		\$158,800
Notes: ¹ Pump station will be replaced ² Decommissioned with Phase I improvements ³ Decommissioned with Phase II improvements ⁴ No rehabilitation identified		



Pump Station Condition Assessment - South

Pump Stations	Rehabilitation	Estimated Cost
Stone Creek Villas	Controls, Access Road	\$20,000
Cedar Lakes #1	Access Road, Fencing	\$15,000
Cedar Lakes #2	Pump Replacement, Access Road, Fencing	\$45,000
Strawberry Hill	Access Road, Fencing	\$15,000
Quail Ridge	Access Road	\$10,000
Harbortowne	Access Road, Fencing	\$30,000
Daycare	Fencing	\$5,000
Stone Bridge	Fencing	\$5,000
Ashmont		4
Diversified Metal		4
McDonalds		2
Platte Valley		2
Hills of Shannon		2
Gerber Collision		4
Woods Court	Fencing	\$5,000
Subtotal		\$150,000
Contingency	25%	\$37,500
Total		\$187,500
Notes:		
1 Pump station will be replaced		
2 Decommissioned with Phase I improvements		
3 Decommissioned with Phase II improvements		
4 No rehabilitation identified		



Projected CIP

Summary of Projected 10-year Capital Improvement Plan

Year	Project	Cost (2020 \$)
2020-2021	Rocky Branch Interceptor & South Booster Pump Station	\$2,350,000
2021-2022	South Pump Station System Modifications	\$500,000
2021-2025	Pump Station Improvements	\$346,300
*	Smith's Fork Pump Station Replacement	\$625,000
2024-2027	Owens Branch - Phase 1 Interceptor	\$6,517,000
2025-2027	WWTP Phase 1 - Liquids Improvements	\$2,260,000
2025-2027	WWTP Phase 1- Solids Improvements	\$1,781,000
Subtotal		\$14,379,300
*City timeline decision		














Discussion

Infrastructure Legends


Legend

-  AIR RELEASE VALVE
-  MANHOLE (EXISTING)
-  MANHOLE (10 YEAR)
-  PUMP STATION (EXISTING)
-  PUMP STATION (10 YEAR)
-  PUMP STATION (ULTIMATE)
-  PUMP STATION (PRIVATE)
-  PUMP STATION (DECOMMISSIONED)
-  WWTP
-  FORCE MAIN (EXISTING)
-  FORCE MAIN (10 YEAR)
-  FORCEMAIN (ULTIMATE)
-  GRAVITY (EXISTING)
-  GRAVITY (10 YEAR)
-  GRAVITY (ULTIMATE)
-  WATERSHED LIMITS
-  CITY LIMITS
-  PARCEL

Zoning Designation

-  A-1, AGRICULTURAL DISTRICT
-  A-R, AGRICULTURAL-RESIDENTIAL DISTRICT
-  B-1, NEIGHBORHOOD BUSINESS DISTRICT
-  B-2, NON-RETAIL BUSINESS DISTRICT
-  B-3, GENERAL BUSINESS DISTRICT
-  B-4, CENTRAL BUSINESS DISTRICT
-  I-1, LIGHT INDUSTRIAL DISTRICT
-  PUD, PLANNED UNIT DEVELOPMENTS
-  R-1A, SINGLE-FAMILY SUBURBAN DWELLING DISTRICT
-  R-1B, SINGLE-FAMILY DWELLING DISTRICT
-  R-2, TWO-FAMILY DWELLING DISTRICT
-  R-3, MULTIPLE-FAMILY DWELLING DISTRICT
-  NOT ZONED














Legend

-  AIR RELEASE VALVE
-  MANHOLE (EXISTING)
-  MANHOLE (10 YEAR)
-  PUMP STATION (EXISTING)
-  PUMP STATION (10 YEAR)
-  PUMP STATION (ULTIMATE)
-  PUMP STATION (PRIVATE)
-  PUMP STATION (DECOMMISSIONED)
-  WWTP
-  FORCE MAIN (EXISTING)
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-  GRAVITY (EXISTING)
-  GRAVITY (10 YEAR)
-  GRAVITY (ULTIMATE)
-  WATERSHED LIMITS
-  CITY LIMITS
-  PARCEL

Legend

-  CITY LIMITS
-  PARCEL

Zoning Designation

-  A-1, AGRICULTURAL DISTRICT
-  A-R, AGRICULTURAL-RESIDENTIAL DISTRICT
-  B-1, NEIGHBORHOOD BUSINESS DISTRICT
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-  I-1, LIGHT INDUSTRIAL DISTRICT
-  PUD, PLANNED UNIT DEVELOPMENTS
-  R-1A, SINGLE-FAMILY SUBURBAN DWELLING DISTRICT
-  R-1B, SINGLE-FAMILY DWELLING DISTRICT
-  R-2, TWO-FAMILY DWELLING DISTRICT
-  R-3, MULTIPLE-FAMILY DWELLING DISTRICT
-  NOT ZONED



SHORT TERM ANNEXATION