CITY OF GREENFIELD
WASTEWATER COLLECTION SYSTEM
MASTER PLAN UPDATE

MAY 2021

City Council
Mayor Lance Walker
Mayor Pro-Tempore Yanely Martinez
Council Member Angela Untalon
Council Member Andrew Tipton
Council Member Robert White

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Table of Contents

List of Tables and Figures

List of Acronyms

ADF	Average Daily Flow
CIP	Capital Improvement Projects
City	City of Greenfield
County	Monterey County
d/D	Depth over Diameter
ENR	Engineering New Record
FOG	fats, oil, and grease
FPS	Feet per Second
Ft	Feet
Ft/Sec	Feet per Second
GIS	Geographic Information System
GPD	Gallons Per Day
GPM	Gallons Per Minute
HDPE	High Density Polyethylene
I/I	Infiltration and Inflow
LF	Linear Feet
MDDWF	Maximum Day Dry Weather Flow
MGD	Million Gallons Per Day
min	Minute
NA	Not Applicable
NAD	North American Datum
NAVD	North American Vertical Datum
O&M	Operation and Maintenance
P.E.	Professional Engineer
PF	Peaking Factor
PHDWF	Peak Hour Dry Weather Flow
PVC	Polyvinyl Chloride
S.F.	Square Foot
SCADA	Supervisory Control and Data Acquisition
VCP	Vitrified Clay Pipe

List of References

1. California Code of Regulations, Title 22.
2. City of Greenfield, 2005-2025 Wastewater System Capital Improvement Plan Update and Capacity Charge Study, June 2005
3. City of Greenfield, 2008 Update of the Wastewater System Capital Improvement Plan Update and Capacity Charge Study, July 2008
4. City of Greenfield, Sewer System Management Plan, 2020 Update
5. City of Greenfield Wastewater Master Plan, 2016
6. US^3 Flow Monitoring, September and October, 2015
7. Progress GIS Files of the Sewer Collection System
8. Greenfield Population – 2018 AMBAG Projections, Draft 2015 UWMP
9. McGraw Hill ENR Construction Cost Index of 10242 (March 2016) and 11455 (August 2020)
10. Metcalf & Eddy design handbook “Wastewater Engineering, Treatment and Reuse, Fifth Edition” 2014
11. Personal Communication with Tony Nisich, MNS, and Arturo Felix, Public Works Manager
12. Smith and Loveless Engineering Orders for Lift Stations

1: Introduction

The City of Greenfield (City) is responsible for the maintenance and operation of the sewer collection system serving the residences and businesses in the City. As older infrastructure is replaced and new development projects are constructed, it is the City's goal to construct sewer collection system improvements to meet the current and ultimate needs of the City. In order to facilitate this goal, and to adequately plan for the capital resources needed to meet this goal, the City commissioned a comprehensive Wastewater Collection System Master Plan (Plan or WWMP) Update that evaluates all aspects of the wastewater collection system and its ability to meet current and long-term needs of the City. It is noted that the City is simultaneously in the process of preparing this Master Plan Update, the Water Master Plan Update, and Wastewater Treatment Plant Master Plan.

Purpose of the Project

Preparation of this Master Plan Update will assist the City in prioritizing both current and future wastewater collection system needs and set forth a mechanism for addressing those needs. The Plan accomplishes the following:

1. Addresses existing deficiencies within the sewer collection system based on today's standards and requirements;
2. Addresses deficiencies within the sewer collection system to meet future build-out needs; and
3. Provides a prioritized list of recommendations with associated hard and soft costs to complete the identified wastewater collection system projects.

Environmental Review

In accordance with Title 14, California Code of Regulations, Chapter 3, Article 18 (Statutory Exemptions), this Wastewater Collection System Master Plan Update is considered a planning study and therefore adoption of this document is exempt from the requirements to prepare Environmental Impact Reports (EIR) or Negative Declarations (ND). Implementation of certain recommended capital improvement projects in future years, will need to comply with CEQA.

Authorization and Scope of Work

On June 11, 2019, the City authorized Wallace Group to prepare this comprehensive Wastewater Collection System Master Plan. This WWMP was prepared in accordance with Wallace Group's proposal dated March 22, 2019. A summarized scope of work is as follows:

1. **Kick-Off Meeting, Project Review Meetings, Field Reviews and Operation Staff Interviews:** Coordinate and attend a kick-off meeting with key Team members and City staff, including interviews with the City's operations staff and a field investigation of the City's lift stations to understand layouts and system operations.
2. **Existing Data Collection:** Develop an information database from existing planning reports, documents, maps, existing system flows, and AMBAG population growth projections. Review City wastewater collection system data, maintenance records, and meet with City staff to

identify areas of concern (high maintenance areas, or HMAs) regarding sewer mains (both gravity and force) and lift stations.

3. **Preliminary Findings Memorandum:** Prepare an updated description and general inventory of the sanitary sewer system based on review of plans, reports, studies, and other City records, visits with staff and field inspections. Visit and document accessible existing facilities and prepare an accurate, up-to-date description of the system. Include existing collection and pumping facilities, including their conditions, document recent capital improvements completed over the past 3 years (since the 2016 Master Plan was prepared) based on record drawings and other detailed information provided by City staff. Forecast ultimate (Year 2040) wastewater flows based on current and future land use, and identified future growth areas in and around the City.

   Sewer Model Development and Calibration: Model and evaluate the existing sewer collection system to determine areas of deficiency including proper design flows and capacity at lift stations. Document existing wastewater flows and projections of future requirements; based on historical wastewater consumption and population, land use, and economic growth projections, quantify sanitary flow requirements; use infiltration/inflow characteristics from the existing system, past sewer system monitoring data, and accepted values for new construction, groundwater infiltration, and rainfall flow factors to develop infiltration/inflow values and wastewater demands for future requirements. Review "hot spots" or high maintenance areas (HMAs) with City staff, and including prior SSO reports, and collectively (with City staff) recommend specific areas for CCTV video by the City.

4. **Lift Station Evaluation: Review design parameters and physical condition of** the lift stations; inventory capabilities of each facility; and collect relevant as-built plans, maintenance records, pump curves, and run logs. Inspection of the existing lift stations will be limited to visual observation of overall conditions of the lift station pumps, wet well and visible piping. Budgetary level costs will be included in the wastewater collection system master plan as part of the recommended capital improvement program (CIP).

Acknowledgements

Wallace Group thanks and gratefully acknowledges the following for their efforts, involvements, input and assistance in preparing this Sewer Collection System Master Plan:

City of Greenfield City Council:

Mayor L**ance Walker**
Mayor Pro-Tempore Yanely Martinez
Council Member Angela Untalon
Council Member Andrew Tipton
Council Member Robert White

City of Greenfield City Staff:

Paul Wood	City Manager
John Alves	Public Works Director
Arturo Felix	Public Works Utilities Manager
Doug Pike (MNS)	City Engineer
Tony Nisich (MNS)	City Engineer

The following Wallace Group key team members were involved in the preparation of this Sewer Collection System Master Plan:

Steven G. Tanaka, PE	Principal Civil Engineer
Kari Wagner, PE	Principal
Kyle Anderson, PE	Senior Civil Engineer
Dylan Goodwin, EIT	Staff Engineer

2: Sewer Collection System Overview

Chapter 2 describes the features of the City's sewer collection system. The details regarding the various sewer collection system features are then presented in subsequent chapters.

Sewer Collection System Background

The City owns and operates a sewer collection system that is comprised of approximately thirty-one miles of gravity sewer pipes ranging in size from 4-inch to 24-inch diameter, and six lift stations. The sewer collection system spans over 2.1 square miles to serve the City's 3,800 customers. For the purposes of this master plan update, only those trunk main sewer lines that were modeled, were included in this exhibit. The existing (modeled) sewer collection system is shown in Figure 2-1. An inventory of existing sewer pipe diameters and materials that were analyzed/modeled for this master plan are provided in Tables 2-1 and 2-2.

Table 2-1 Modeled Pipeline Inventory by Material

Material	Length	
	Feet	Miles
ACP	2,414	0.5
HDPE	8,339	1.6
PVC	26,986	5.1
VCP	17,348	3.3

Lift Stations

The City owns six (6) lift stations (all Smith & Loveless wetpit/drypit lift stations) located throughout the collection system which are shown on Figure 2-2 and are briefly summarized in this chapter. Lift station tributary areas are also shown on Figure 2-2.

Table 2-2 Modeled Pipeline Inventory by Diameter

Diameter	Length	
	Feet	Miles
8	13,334	2.5
10	9,483	1.8
12	17,886	3.4
14	225	0.0
18	5,820	1.1
21	2,946	0.6
24	5,394	1.0

- Tyler Lift Station: Tyler Lift Station is located at the intersection of El Camino Real and Tyler Avenue. The lift station discharges through a 6-inch diameter PVC force main to a manhole near the intersection of Huerta Avenue and El Camino Real.
- Los Ositos Lift Station: Los Ositos Lift Station is located at the intersection of 11th Street and Elm Avenue. The lift station discharges through an 8-inch diameter PVC force main to a manhole near the intersection of 11th Street and Maple Avenue.
- Vineyard Lift Station: Vineyard Lift Station is located on Vineyard Avenue, south of Apple Avenue. The lift station discharges through a 4-inch diameter PVC force main to a manhole to the northwest of the lift station in Apple Avenue.

- Nino Lift Station: Nino Lift Station is located at the intersection of Nino Lane and Del Ponte Drive. The lift station discharges through a 4-inch diameter PVC force main to a manhole to the northwest of the lift station near the intersection of Del Ponte Drive and Nino Lane.
- Reed Lift Station: Reed Lift Station is located near the intersection of Reed Lane and De Leon Drive. The lift station discharges through a 6-inch diameter PVC force main to a manhole near the intersection of Reed Way and El Camino Real.
- Cypress Lift Station: Cypress Lift Station is located near the intersection of Cypress Avenue and El Camino Real, .and serves The Yanks Museum Development. The lift station discharges through a 10-inch diameter PVC force main to a manhole near the intersection of Pine Avenue and El Camino Real.

LEGEND

- LIFT STATIONS
- SEWER MANHOLE
- CITY BOUNDARY
- 8"
- 10"
- 12"
- 14"
- 18"
- 21"
- 24"

Cypress Lift Station

Reed Lift Station

Vineyard Lift Station

Nino Lift Station

Los Ositos Lift Station

Tyler Lift Station

Thorne Rd
Cypress Ave
Cherry Ave
Livingston Rd
el Camino Real
Pine Ave
Orchard St
Apricot St
McDonald Way
Dart Way
Bywood Way
de Leon Cir
Walnut Ave
Harvest Way
Paloma Way
Paloma Dr
Gavilan Dr
Chalone Dr
Pinnacles Ave
Pasque Ave
Hutchinson Dr
Fransconi Dr
Clifton Ct
10th St
12th St
13th St
14th St
Primavera Ct
Larson Ln
11th St
Elmwood Dr
Madera Ave
Calaveras Way
Tehama Way
Acacia Ct
7th St
8th St
9th St
10th St
11th St
Pepper Dr
Palm Ave
Ventana Ave
Palm Ave
Oak Ave
Maple Ave
4th St
5th St
6th St
7th St
8th St
Palo Verde St
Maple Ave
Elm Ave
Elm Ct
Ann Scott Dr
Moreno St
Huerta Ave
Walker Ln
St Charles Pl
Park Ave
Tyler Ave
Vasquez Ave
Moreno St
St Matthew St
Tyler Ave
Emily Cir
Scott Cir
Heidi Dr
Vincente Dr
Don
Gianolini Pkwy
Clark Colony Ave
Romo Dr
Greenleaf Loop
Los Padres Ct
San Antonio Dr
Renfro Pl
Meadow Cir
Parkside Ct
Hicks Dr
Morris Way
Morris Ave
Victorian Cir
Apple Ave
Sparks St
Maldonado St
Canal St
Oak Ave
Cherry Ave
2nd St
Tawny Port Way
Sirrah Way
Barolo Cir
Tuscany Way
Tuscany Ave
Thorp Ave
Beech Ave
Apple Ave
Rava Pkwy
Bella St
Ave St
Alves Ln
del Ponte Dr
Vineyard Dr
Burgundy Dr
Chardonnay Dr
Riesling Ave
Las Manzanitas Dr
Wilson Cir
Chablis Cir
1st St
Espinosa Rd
Susan Ln
Patricia Ln
Underwood Rd
US Hwy 101

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Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

FIGURE 2-1
SEWER COLLECTION SYSTEM OVERVIEW

N

1 inch = 1,500 feet

0 750 1,500

Feet

LEGEND

- LIFT STATIONS
- SEWER MANHOLE
- Sewer Lines
- CITY BOUNDARY

Tributary Areas

- Cypress
- Los Ositos
- Nino
- Reed
- Tyler
- Vineyard

Cypress Lift Station

Reed Lift Station

Vineyard Lift Station

Nino Lift Station

Los Ositos Lift Station

Tyler Lift Station

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FIGURE 2-2
LIFT STATION TRIBUTARY MAP

1 inch = 1,600 feet

N

0 800 1,600

Feet

3: Study Area Characteristics

Chapter 3 describes the study area characteristics germane to this Wastewater Collection System Master Plan Update for the City. Included in this chapter is a description of the various land uses in the service area, future development projections, and existing and future population projections. Future development is based on the 2005 General Plan Land Use Element, recent annexations and identified future growth areas provided by City Staff.

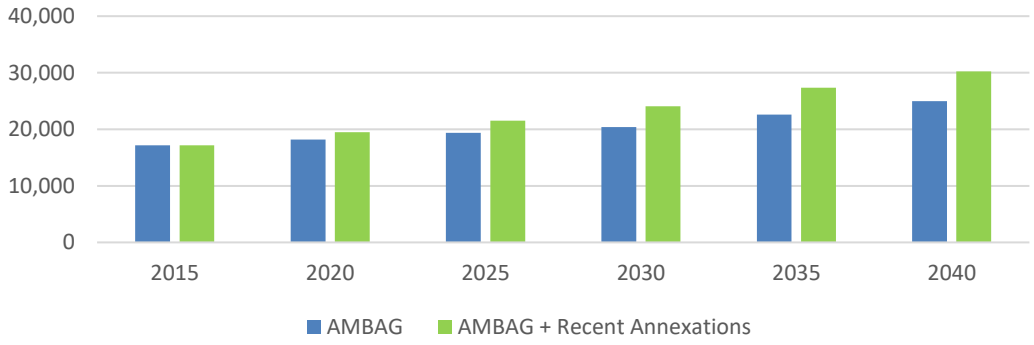
Population

The City relies on the Association of Monterey Bay Area Government (AMBAG) regional growth forecasts for population projections through the master plan planning period. As referenced from the City's 2015 (draft) Urban Water Management Plan, the City is expected to reach a population of 25,000 by Year 2040. Refer to Table 3-1 and Figure 3-1 for tabular and graphic portrayals of the City's population projection. However, recently annexed developments such as the Pinnacles, the Yanks, Las Vinas Subdivision, Miramonte Subdivision and planned areas outside City limits (Consolidation Areas, farm housing units outside of City limits), may not be represented in future population growth projections for the City. In addition, population was added to address farm worker housing within The Vines development; 112 high density residential units were projected with a household density of 8 per unit. For the purposes of this master plan update, population equivalents for developments recently annexed into the City limits (Pinnacles, Las Vinas Residential, Miramonte Residential) and the Consolidation Areas, with the exception of The Yanks, have been added to the AMBAG population estimates. The adjusted population growth projections are shown in Figure 3-1, and summarized in Table 3-2. It is noted that there will be no new net permanent population as a result of the Yanks Development; however, water and sewer demands for the Yanks Development will be added to the future water and sewer flow projections, by incorporating these demands in to the per capita water demands and wastewater flows. Furthermore, employment from the Yanks Development will support population increases throughout the City, whether from within existing developed residential areas of the City, or within new development areas.

Table 3-1. Greenfield Population Projections

Year	Population	
	AMBAG	AMBAG Plus Recent Annexations
2015	17,147	17,147
2020	18,200	19,481
2025	19,400	21,450
2030	20,400	23,988
2035	22,600	27,213
2040	25,000	30,125

Figure 3-1. Greenfield Population Projections

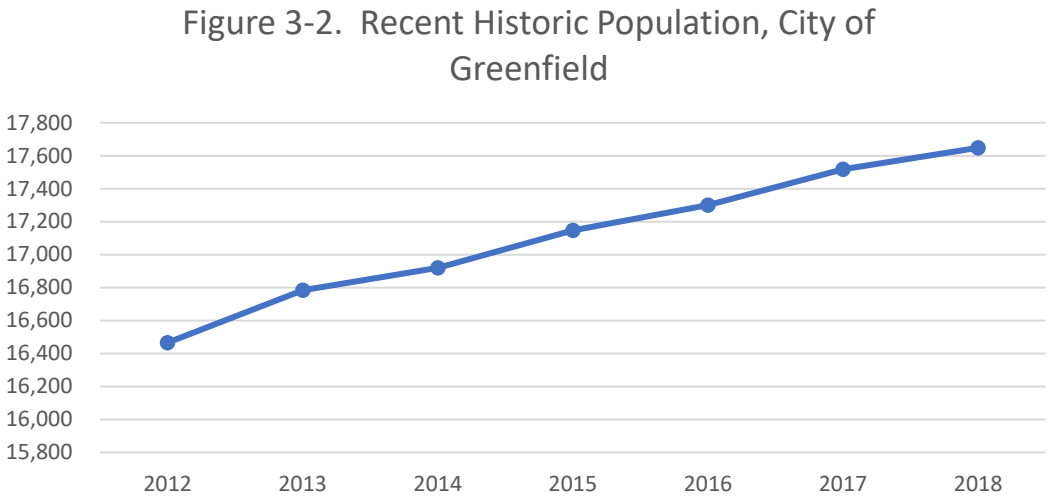


Although the City's historic growth rate from 1970 to 2000 ranged between 4.5% to 5.5% over this 30 year period, the population growth rate is projected to maintain a lower growth rate of around 1.5% per year. This growth projection is lower than the projection used in the 2016 Water Master Plan, which projected a population of 28,400 by Year 2035. Figure 3-2 shows the recent historic population trend for the City of Greenfield. It is noted that this population projection is representative of growth within the City's current City Limits.

Table 3-2. Population Expected for Recently Annexed Areas

Development	Units	Unit Type	Population[a]
Miramonte	166	SFR	796.8
Pinnacles	286	SFR	1373
	208	MFR	998
Las Vinas	182	SFR	873.6
The Vines/Avila Farm Worker Housing[b]	112	MFR	896
Consolidation Areas	39		312
TOTAL:			**5,250**

[a]Household density of 4.8 used, except for Avila Farm Worker Housing as noted.
[b]Household density of 8 used.



Land Use

The City of Greenfield is located in the Salinas Valley in Monterey County. Founded in 1905 and incorporated in 1947, Greenfield is centered in a highly productive agricultural region. Figure 3-3 illustrates the City's newly updated land use map and City boundary which includes recently annexed areas (includes the Yanks, the Pinnacles, Miramonte Residential, Las Vinas Residential). This figure illustrates the new and pending developments, and recent annexations within this newly revised City boundary. Table 3-3 summarizes the Land Use Designations and Projections (from the 2005 General Plan, plus recent updates), including recent annexations for major developments such as The Yanks, Pinnacles, Miramonte Residential Development, and others. This table provides a breakdown of acreage designated for each land use.

Future Development

The City's Community Development Department provided a summary of the future development anticipated within the City. Much of this development is moving forward, and a number of parcels have been annexed into the City as indicated previously. A summary of future and pending developments are included in Tables 3-4 and 3-5. There will also be a number of cannabis facilities that will develop within the City in the coming years, as summarized in Table 3-5.

Table 3-3 Land Use Designations and Projections Within City Limits

General Plan Land Use	Land Use/Zoning Within City Limits, Acres		
	Total Acreage Within City Limits	Future Development Within City Lmits[a]	Future Development Description
Low Density Residential	183	113.7	Miramonte, Vintage Meadows, Las Vinas, Pinnacles
Medium Density Residential	244	19.4	Pinnacles
High Density Residential	47	41.9[b]	EAH, Walnut Grove Phase 2, Pinnacles
Neighborhood Commercial	6		
Downtown Commercial	41	0.6[c]	T4B2
Highway Commercial	89	54.2[c]	Pinnacles, The Vines (portions already completed), Couttelenc
Professional Office	21	5.4	Regional Courthouse, Mee Memorial Medical Clinic
Light Industrial	105	7.6[c]	Greenfield Self Storage
Heavy Industrial	65	65	Pinnacles
Public Quasi Public	240	17	Arroyo Seco Elementary School, Pinnacles Elementary School
Recreation and Open Space	44	16.6	Pinnacles, The Vines
Artisan/Agricultural Visitor	125	108	Yanks Museum
Destination Commercial	9	8.8	Pinnacles
Cannabis	15[d]	54	4 Acres zoned Highway Commercial; 5 acres zoned Downtown Commercial; Remainder Zoned Light Industrial
TOTAL	1,234	512	

[a]Projected future growth remaining within City Limits (new development, see Table 3-4). In-fill was assumed to be minor and is not included in this estimate.
[b]Note, for Walnut Grove Apartments Phase 2 and EAH, land is zoned medium density, but was listed as high density due to proposed density of units proposed.
[c]Land zoned light commercial, Highway Commercial, Gateway/Mixed Use, but planned for cannabis facilities are projected as a separate item later in this table.
[d]900 Cherry Avenue, 1071 Cherry Avenue (existing).

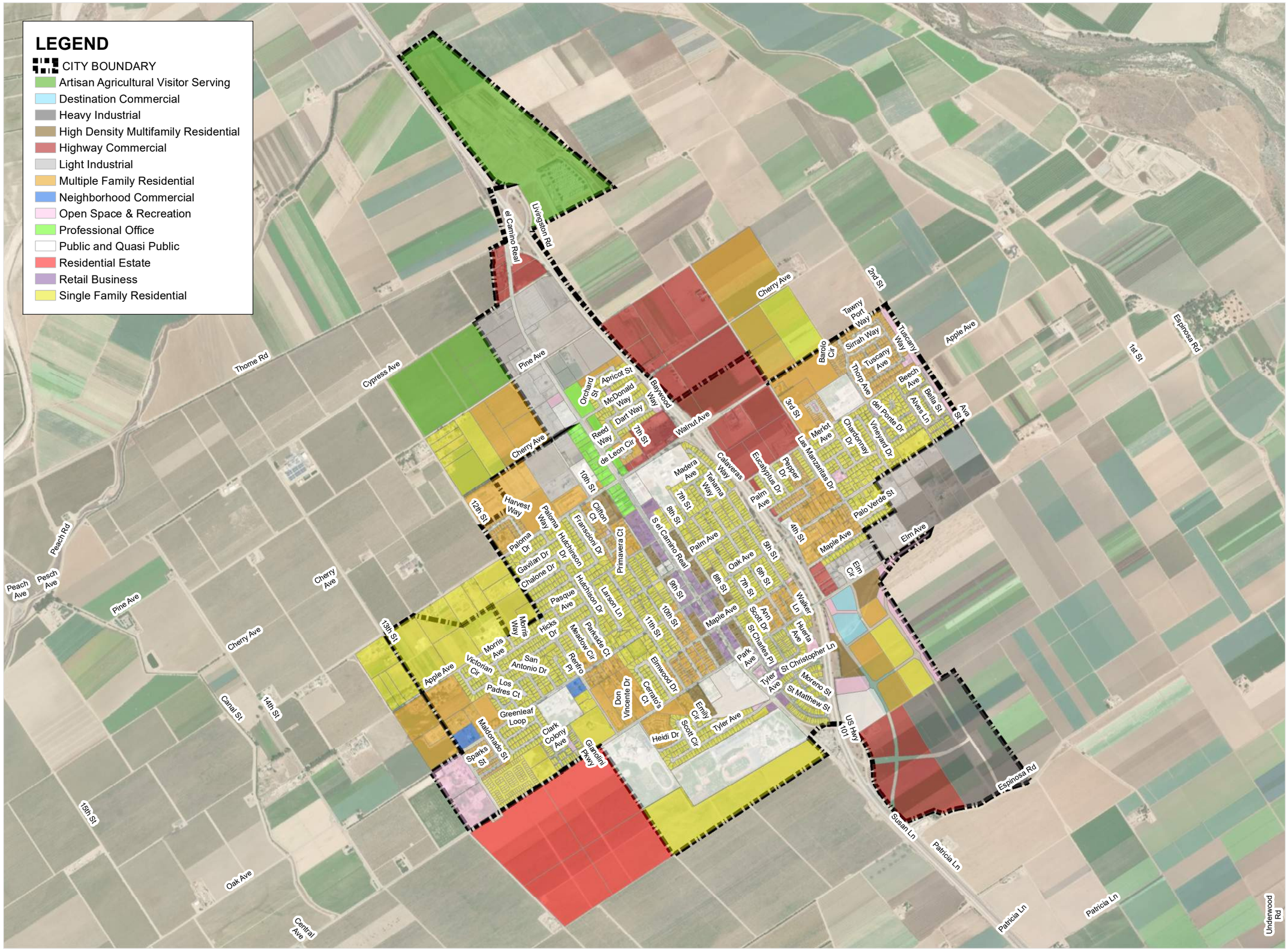


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FIGURE 3-3
EXISTING AND FUTURE ZONING

N

1 inch = 1,700 feet

0 850 1,700

Feet

M:\1163-Greenfield_City of\008-Water and Wastewater Master Plan Updates\12 - GIS\Figures\Fig. 3-3 Existing and Future Zoning.mxd; Author: <MAP AUTHOR>

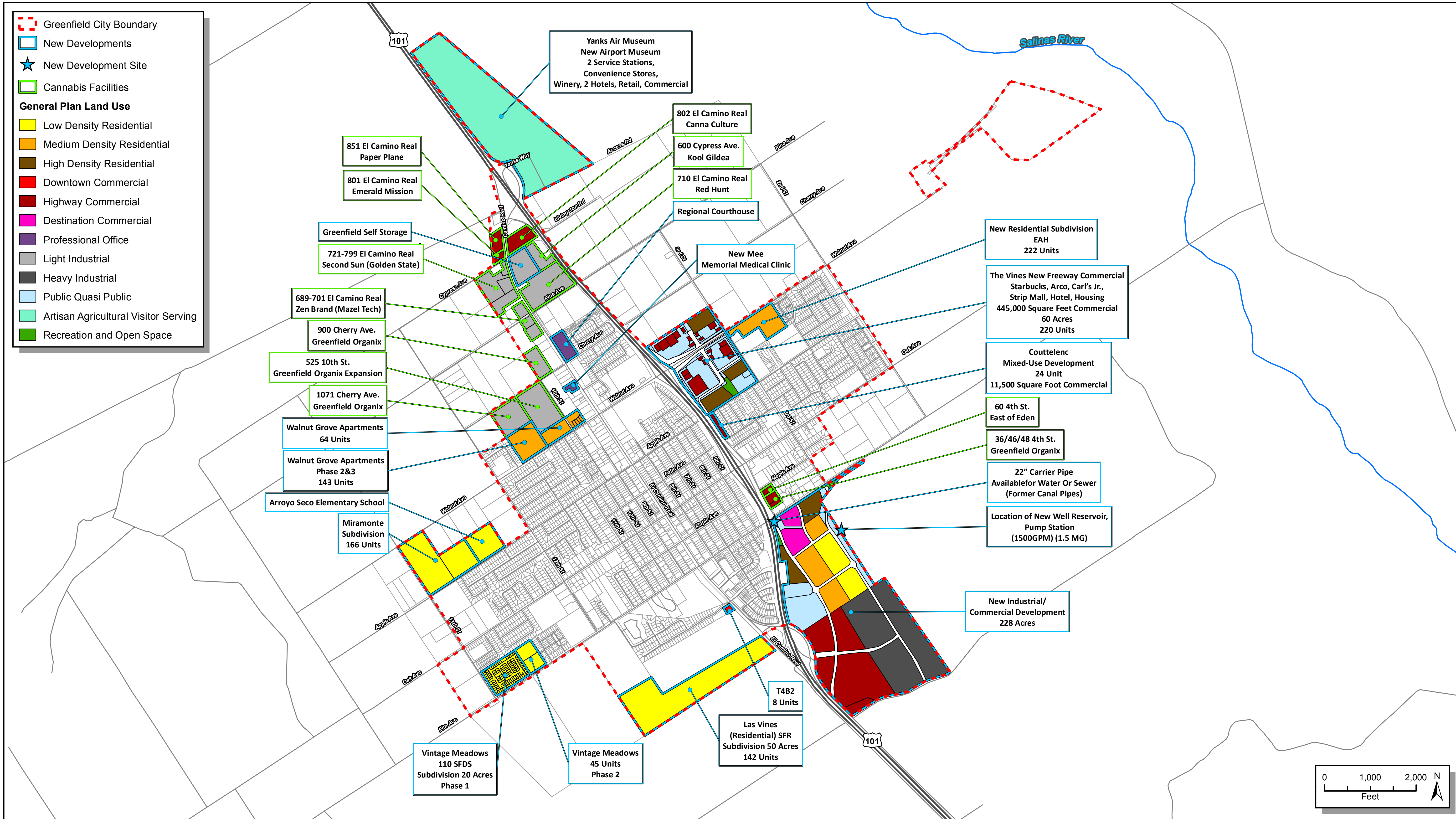


FIGURE 3-4
GREENFIELD NEW AND PROPOSED
DEVELOPMENTS SINCE 2016

Table 3-4. Summary of Future/Pending Developments, City of Greenfield

Proposed Development	Current Land Use/Zoning	Acreage	No. of Units/Description
Mee Memorial Medical Clinic	Professional Office	1	
Walnut Grove Apts Phase 1	MDR[a]	6.5	207 (12.5 DU/acre)[a]
Walnut Grove Apts Phase 2 and 3	MDR[a]	10	
Regional Courthouse	Professional Office	4.4	100 Employees
Greenfield Self-Storage	Light Industrial	7.6	
Arroyo Seco Elementary School	LFR	9.4	
Miramonte Subdivision Units[b]	LDR	28	166 Units (5.9 DU/acre)
Apple Avenue Consolidation Area	Outside Planning Area & City Limits	--	19 Units (water service only)[c]
Walnut Avenue Consolidation Area	Outside Planning Area & City Limits	--	20 Units (water service only)[c]
Vintage Meadows	LDR	20	155 (5.2 DU/acre)
Las Vinas	LDR	50	182 (2.8 DU/acre)
T4B2	Downtown Commercial	0.6	8 units
Pinnacles[b]	Downtown Commercial/Heavy Industrial	228	Industrial, Residential, Commercial (LDR, 6.5 DU/acre; MDR 9.5 DU/acre; HDR, 20 DU/acre)
Couttelenc Mixed Use	Highway Commercial	1.5	11,500 SF Commercial
The Vines (New Freeway Commercial)	Walnut Avenue Specific Plan Area/Regional Commercial	60	Starbucks, ARCO, Carl's Jr., Strip Mall, Hotel, Housing 220 Units[d], 220,000 SF Commercial
New Residential Subdivision EAH (Walnut at 3rd, SE Corner)	MFR[d]	11	222 (20 DU/acre)[e]
Yanks Museum[b]	Artisan Agricultural Visitor Serving	135	Airport, museum, 2 service stations, convenience stores, winery, 2 hotels, retail commercial

[a]The Walnut Grove Apartments have a density of 12+ DU/acre, consistent with zoning for HDR development.
[b]Recently annexed into the City.
[c]Although wastewater service is not anticipated at this time, the sewer model will address potential impacts should this are be provided wastewater service in the future.
[d]Includes Avila Farm Housing, 112 units with estimated household density of 8.
[e]EAH has a density of 20 DU/acre, consistent with HDR development.

Table 3-5. Cannabis Facilities in Greenfield - Existing and Proposed

Proposed Development	Current Land Use/Zoning	Acreage	No. of Units/Description
Paper Plane - 851 ECR	Highway Commercial	3	Pending
801 ECR - Emerald Mission	Highway Commercial	1	Pending
Canna Culture - 802 ECR	Gateway and Mixed Use	5	Pending
Kool Gildea - 600 Cypress	Light Industrial	4	Pending
Redhunt & Auric Valley - 710 ECR	Light Industrial	15	Approved
Golden State - 799 ECR	Light Industrial	13	Pending
Golden State - 721 ECR	Light Industrial		Approved
Zen Brand - 689, 699, 701 ECR	Light Industrial	5	Pending
Greenfield Organix - 900 Cherry[a]	Light Industrial	5	In operation
Greenfield Organix - 1071 Cherry[a]	Light Industrial	10	In operation/recently completed
Greenfield Organix II - 525 10th Street	Light Industrial	15	Pending
East of Eden - 60 4th Street (Existing Building)	Highway Commercial	1 Acre (In Existing Building	Pending[b]
Green Organix - 36/46/48 4th Street (Existing Building)_	Highway Commercial	2 Acres (In Existing Building)	Pending[b]

[a]Existing Cannabis facilities, in operation.
[b]These facilities are not expected to impact water demands due to their size and nature, with operations limited to existing buildings. However, no information was available to assess such potential impacts.

General Plan Land Use Designations

As part of this master plan update, Wallace Group reviewed the City's general plan, and compared new and proposed developments to current land/use zoning, as a means of determining whether some densification of development may be occurring, and if so, where water demand and sewer flows may need to be adjusted in the model to accommodate such demands. Some key zoning aspects are as follows:

- Low Density Residential (LDR) – up to 7 DU per acre, maximum parcel size 6,000 SF.
- Medium Density Residential (MDR) - 1 to 7 DU per acre, minimum parcel size 2,900 SF. Refer to Table 4, Walnut Grove Apartments, which are high density residential units being developed on lands zoned MDR. Concentration of water demands and wastewater flows for these parcels will be based on the proposed development (High Density Residential apartments) as opposed to MDR single family homes.
- High Density Residential (HDR) - 10 to 21 DU/acre, primarily geared towards multi-family and apartments.
- Light Industrial - uses such as processing, packaging, machining, repair, fabrication, distribution, warehousing and storage, research and development, and other such uses. It is noted that most cannabis facilities will be developed on commercial and industrial zoned lands. Based on review of the 900 Cherry Avenue cannabis water demands, the intensity of water use is higher than what would normally be seen for the given land use. Further discussion of this is expanded upon in the discussion of future demands (in the Water Master Plan Update Report).
- Heavy Industrial - similar type uses as light industrial, except that such uses may incur undesirable impacts such as noise, dust, odor and vibration. These land designations would be placed well away from residential areas and commercial areas to minimize such impacts.
- Highway Commercial - broad range of commercial and service activities requiring convenient vehicular access and adequate parking. It is noted that Canna Culture, Emerald Mission and Paper Plane (cannabis) facilities will be developed on lands zoned highway commercial.

Considerations for Specific Developments

Consolidation Areas (Farm Housing). There will be 39 units of consolidation farm housing in western Greenfield. These two areas are outside City limits, and the City will provide potable water service to these units, but not sanitary service. Thus, these units are expected to be served by on-site wastewater system(s). The regulatory aspects of serving these units with on-site treatment systems is not part of this master plan study. However, Wallace Group recommends that this master plan model and evaluate the potential for wastewater flows from these housing units, in the event that they will be served by the City municipal wastewater plant in future years. We propose to project water demands and sewer flows based on the following assumptions:

- Household Density is assumed to be same as what was used for Walnut Avenue Apartments, 3-bedroom apartment, at 8 persons per unit.
- The consolidation areas (39 units total) will be anticipated to be fully "built out" by Year 2025.
- Potable Water:
    - The farm housing units will have little to no irrigation demand.
    - Potable water demand is projected at 80 gpcd based on current calculated residential per capita water demands throughout the City. This will be slightly conservative in that this per capita demand, that is representative of City domestic demand (metered dwelling units), incorporates outdoor demand.
- Wastewater Demand will be projected at 60 gpcd, similar for City-wide population estimates of wastewater flow.

Pinnacles, Yanks, Las Vinas and Miramonte Residential Development. These development areas, recently annexed into the City limits, will be addressed as follows:

- Pinnacles, Las Vinas and Miramonte developments. Calculated population will be added to the published AMBAG population estimates, as it is assumed that the AMBAG population forecasts do not include these recent developments. This population augmentation will then project water demands and wastewater flows.
- Yanks. There will not be permanent population associated with the Yanks development, but the water demands (up to 68,000 gpd) will be projected based on an added buffer to the recommended per capita demand. Likewise, the sewer collection system demand of 62,000 gpd ultimate, will be incorporated into the overall per capita demand for wastewater. It is noted that employment at The Yanks will likely be supported by permanent residents predominantly from the City of Greenfield.

For other developments listed in Tables 3-4 and 3-5, including The Vines Development (Walnut Area Specific Plan Area), water demands and sewer flows will be applied to the corresponding models based on unit factors developed. Additional demands to the models will include water demands and wastewater flows from The Avila farm worker housing, estimated at 112 units with a household density of 8 per unit (population 896). As noted earlier, population estimates for recent annexations were added to the AMBAG population projections used in Table 3-1.

Cannabis. Most cannabis facilities will be developed on lands zoned light industrial. A review of statewide water demand data for light industrial development indicates that demands are typically between 500 and 2,000 gpd/SF with the lower range between 500 and 1,000 gpd/SF being more prevalent. However, actual demands are dependent on the specific nature of the light industrial facility proposed. In the 2016 City of Greenfield Water System Master Plan, a unit demand factor of 1,278 gpd/connection (400 gpd/acre) was applied to parcels zoned light industrial. Based on water meter data provided by the City, the Cherry Avenue cannabis facility water demand for the first year of operation was calculated at 2,700 gpd/acre (approximately 3 AFY/acre) which is similar to the water demand for golf course/turf irrigation). Thus, the proposed cannabis facilities have a much larger water demand than the modeled demand from the 2016 Master Plan. Wallace Group recommends adding the difference in intensity (2,300 gpd/acre) to the projected per capita water demands, and also adjusting the distribution of water demands in the water model to address potential hydraulic impacts from these cannabis facilities. The total combined acreage of light industrial lands expected for cannabis is 69 acres. This results in an increased water demand for light industrial of 69 acres x 2,300 gpd/acre, or approximately 160,000 gallons of water usage per day. This results in a per capita water demand increase of 6 gpcd, which has been accounted for in overall water demand projections.

Wastewater generation overall for the City is assumed to be adequate to project wastewater flows from the cannabis facilities. However, a review of specific internal operations should be conducted by the City to understand to what degree greenhouse drains may be contributing to wastewater flow and the nature and quality of wastewater generated. The 900 and 1071 Cherry Avenue cannabis facilities have reverse osmosis units to reduce total dissolved solids (TDS) in the irrigation water used, and discharge brine waste directly to the sewer. Also, we understand that the facility allows drainage from the

irrigation operations to discharge to the sewer. These operational practices may impact both the quantity and quality of the wastewater to the collection system. For this master plan, general assumptions will be used to estimate the volume of wastewater flow coming from the cannabis facilities.

Walnut Grove Apartments. The Walnut Grove Apartments will be developed on land zoned medium density residential. The proposed density of these apartments is approximately 14 DU/per acre, which is closer to high density residential. It is assumed that the AMBAG population estimate covers the population increase from the complex. However, this denser development for the Phase 2 apartments could result in a population increase of 200 persons or more above what the property is zoned for (MDR). Although the overall population estimate addresses overall water demand and wastewater flows, the densification of this development will be incorporated into both the water and sewer models with respect to how water demand and sewer flows are distributed.

Future Growth Areas

The City has identified areas in the northeast area of the City as future growth areas. There are two distinct areas as shown on Figure 3-4. These areas are not within City limits or the Sphere of Influence, but have potential for annexation into the City in future years. This is a significant area, and may need to be addressed as part of future master plan updates. The areas are described as follows:

- Future Study Area. This area is comprised of 281 acres, and does not have defined zoning/land use designations.
- Other Development Area. This area shown on Figure 3-5 is comprised of 157 acres. This land does have zoning/land use defined in the General Plan (based on GIS data provided by the City); however, this area is not incorporated into the City.

This future potential area is significant, in total this area is 438 acres (compared to 1,234 existing acreage within City limits), and is equivalent to 35% of the current total land area within the City. If this area is combined with the total Master Plan “build-out” and planned development areas, the combined master plan development area plus this Future Growth Area, has the potential to see the City grow by 35% over the existing City development of current.

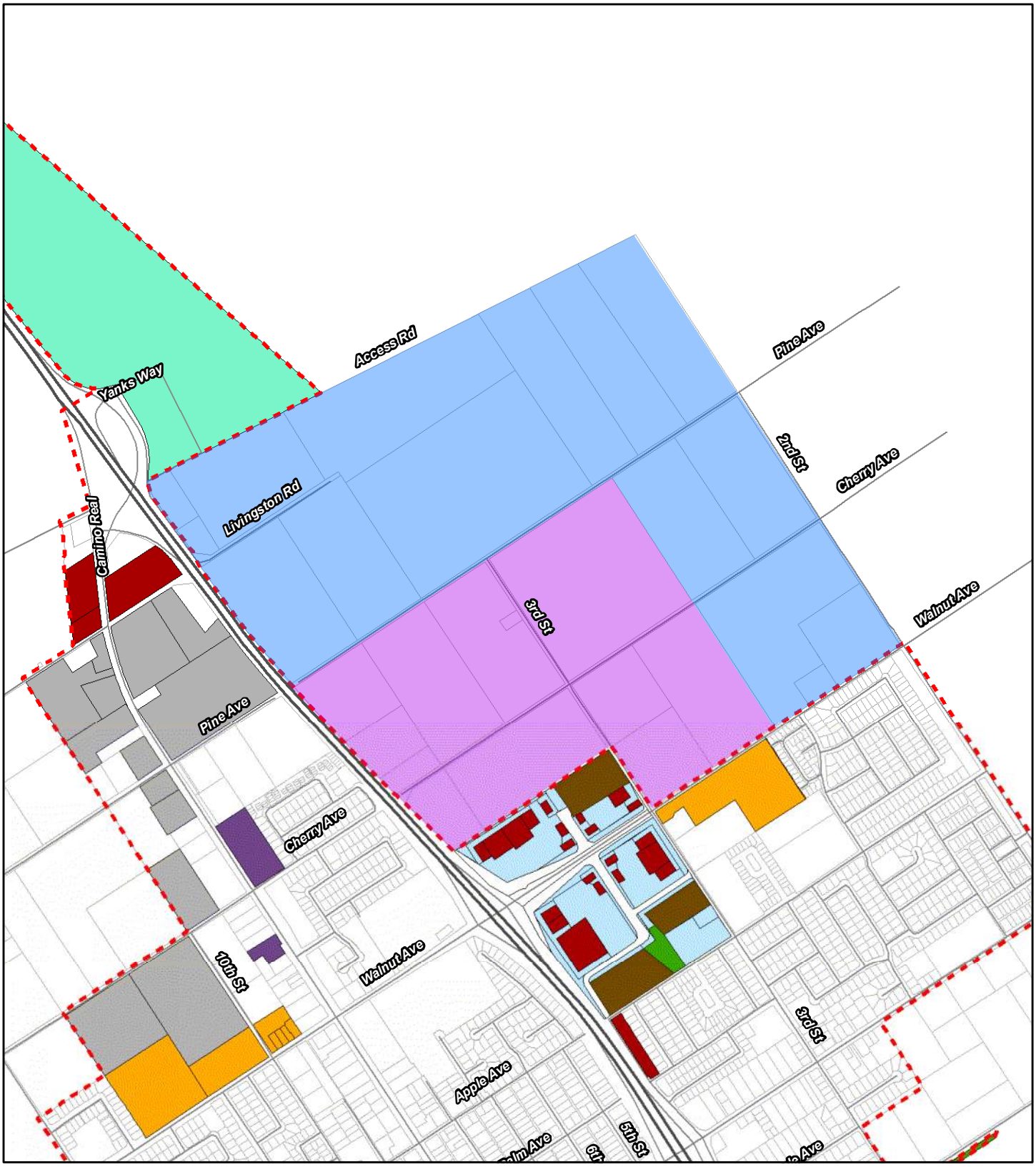


Figure 3-5 Potential Future Development Areas

Future Study Area (281 Ac)

Other Development Area (157 Ac)

Greenfield City Boundary

Parcels

N

0 500 1,000 2,000

Feet

WALLACE GROUP

This master plan update includes a "broad brush" modeling and impact analysis of this potential future growth area (discussed below), and how it may impact water and sewer infrastructure needs. Using the City's current water demand and sewer flows, and based on existing land area, general demands were projected for the Future Study Area and Other Zoned Area of the City. The unit demands per acre are presented in Table 3-6, and are based on the existing City demands divided by existing City acreage (1,234 acres) that is developed. These unit demands will be input into the water and sewer models, and general model runs will be conducted to determine how such development demands may impact existing infrastructure.

Table 3-6. Unit Demands for Water/Wastewater

Existing City Water and Sewer	Existing Demand/Flow, mgd	Demand, gpd/acre	Development Area Demand (438 acres)
Water Demand	1.55	1,256	0.55 mgd
Sewer Flow	1.0	810	0.36 mgd

Future Growth Area Considerations

Sewer flows from Table 3-6 were added to the future wastewater demand model run, with the flows being added to existing sewer manholes on Cherry Avenue and 3rd Street. These "broad brush" findings are presented in this Chapter 3 so as not to get mixed in with Master Plan CIP recommendations in Chapter 5 and 7.

If this future growth area (shown in Figure 3-4) is annexed into the City and developed in the future, the following considerations are listed as follows:

- Assuming all wastewater flows from this Development area would enter the existing gravity sewer in Cherry Avenue and 3rd Street, and then to the sewer in Walnut Avenue, no additional deficiencies in the existing modeled sewer were noted, assuming the 14" gravity sewer to the WWTP (from MH 649 to 650) is upgraded to 24" diameter. If the 14" sewer is not upgraded, then a bottleneck occurs and there is a deficiency upstream in the existing 24" sewer in Walnut Avenue from MH 659 to 662.

4: Wastewater Flows

Chapter 4 describes the existing and projected sewer flows for the City. The sewer flow forecasts will form the basis for identifying and updating existing and future system needs and analyzing deficiencies. The projected future flows are based on the land use/zoning, development and population information presented in Chapter 3.

Wastewater Flow Monitoring

As part of the 2016 master plan effort, in conjunction with US[3], in-line sewer flow monitoring was conducted at three select locations, from September 24, 2015 through October 28, 2015. The main goal of this data was to develop peaking factors for the hydraulic model. The data can also provide very useful information on flow patterns and if/when sewers may be surcharging. Figure 4-1 shows the locations of the three flow monitoring locations chosen for this prior study. This flow monitoring data was reviewed, and it was determined that further in-line flow monitoring was not warranted for this master plan update.

Collection System Peaking Factors

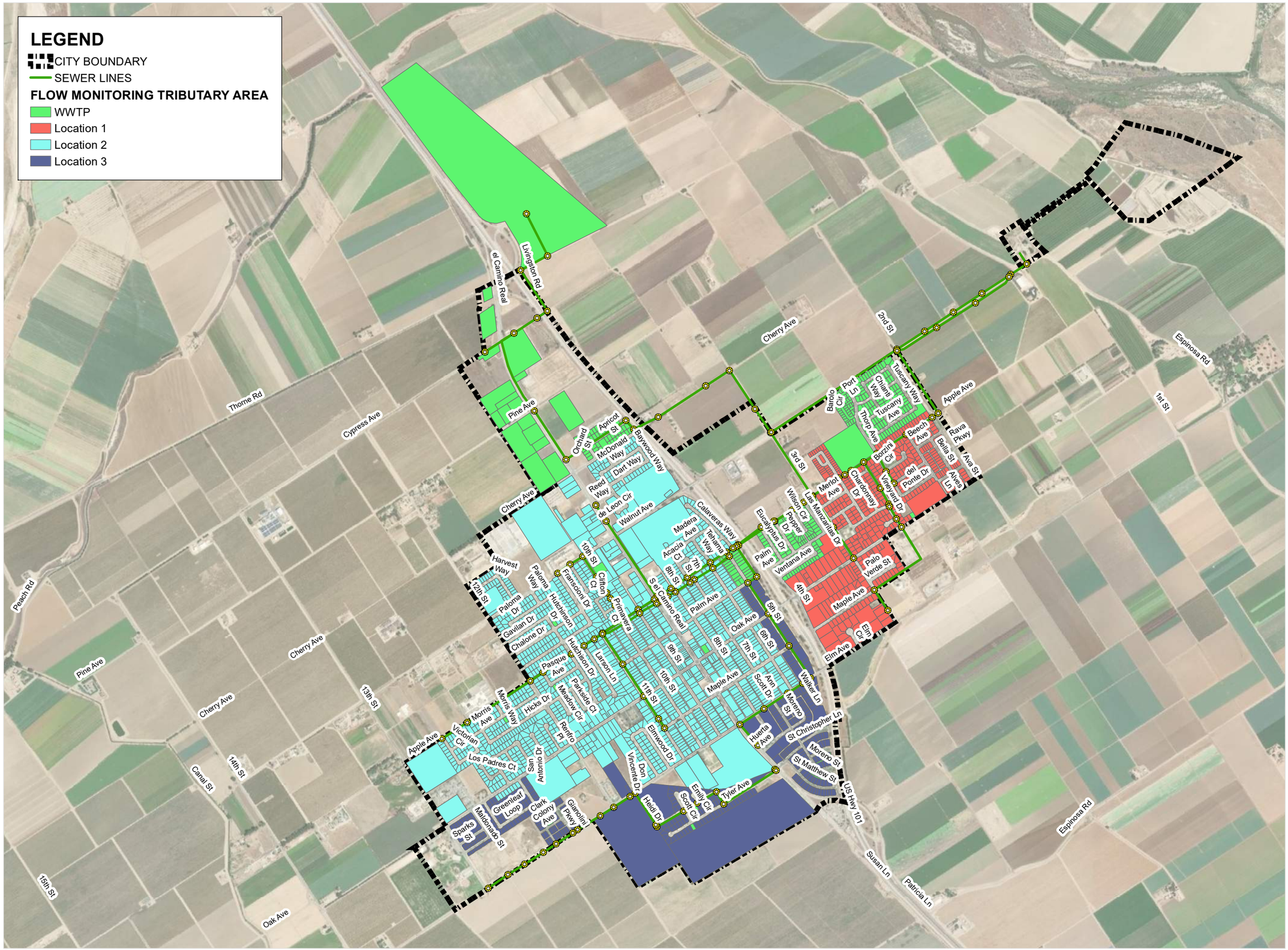
As part of the flow analysis mentioned above, peaking factors were derived from the in-line flow monitoring, and were be used in the sewer collection system model. Table 4-1 summarizes the peaking factors derived at each monitoring location.

Table 4-1. Summary of Peaking Factors in Sewer Collection System

Location	Peaking Factor
2nd Street/Apple Avenue	2.0
Apple Avenue/Freeway 101	2.0
Apple Alley/Palm Avenue	2.0
WWTP	2.75

Wastewater Flows

The City of Greenfield has seen a 7% overall population increase since 2012. During the major drought period of 2015 and 2016, the City's water use and corresponding wastewater flows decreased significantly in response to the drought. The historic population, wastewater flows, and per capita wastewater flow data is summarized in Table 4-2. Figure 4-2 depicts this same information in graphic format, showing recent historic population and wastewater flow trends from 2012 to 2018. Based on this data, the per capita wastewater flow generated has stabilized at around 55 gallons per capita per day (gpcd**). For this master plan update, it is recommended that future wastewater flows be based on 60 gpcd, to provide some margin/buffer for future wastewater flow projections**. Future projected wastewater flows are expected to reach 1.8 mgd by Year 2040.



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Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

FIGURE 4-1
FLOW MONITORING BASIN MAP

N

1 inch = 1,600 feet

0 800 1,600

Feet

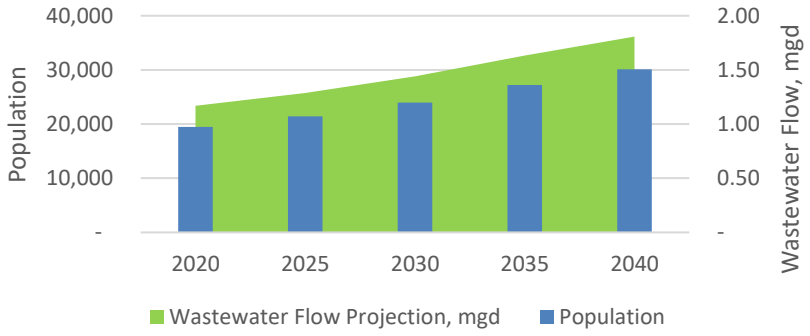
Yanks Development

The Yanks development, which is estimated to have a build-out wastewater flow of 62,000 gpd, was not included in the wastewater per capita flow projections in Table 4-2. However, a review of the projected wastewater flows indicates that the Yanks development adds approximately 2.2 gpcd to the calculated per capita wastewater demands. Therefore, the 60 gpcd recommended per capita wastewater flow provides sufficient buffer to account for future flows from the Yanks. The sewer collection system model will address distribution of wastewater flows to accommodate the 62,000 gpd wastewater flow projection at the appropriate location in the sewer model.

Table 4-2. Summary of Population, Wastewater Flow and Per Capita Wastewater Flows

Year	Population	Annual Average Flow, mgd	Per Capita Wastewater Flow, gpcd
2012	16,466	1.02	61.9
2013	16,784	1.00	59.6
2014	16,919	0.98	57.7
2015	17,147	0.92	53.4
2016	17,300	0.94	54.5
2017	17,517	0.96	54.6
2018	17,648	0.96	54.3

Figure 4-2. Wastewater Flow Projection for Planning Period



5: Collection System Analysis

This Chapter presents the analysis of the gravity wastewater collection system for the City of Greenfield. Refer to Chapter 2 for an overview of the City's wastewater collection system. Refer to Chapter 7 for the proposed capital improvements based on the analysis presented in this Chapter.

Introduction

The City's wastewater collection system consists of a network of 8-inch to 24-inch gravity sewer mains, and six (6) lift stations. The main trunk sewer system was analyzed using a computer based hydraulic model as part of this Sewer Master Plan Update project, to evaluate performance of the wastewater collection system under both existing and future conditions. Figure 2-1 provides an overview of the sewer mains that were included in the hydraulic model.

The analysis of the wastewater collection system is based on a sewer Geographic Information System (GIS) developed using survey data collected by Wallace Group in conjunction with record drawings available for sewer utilities throughout the City.

Collection System Analysis Criteria

As described in the City's Sanitary Sewer Management Plan (SSMP), Element 5: Design and Performance Provisions, the City defers to the City of Salinas Standard Specifications, Design Standards and Standard Plans for standardized design for the wastewater collection system. The recommended design criteria are summarized in Table 5-1. These criteria provide capacity buffer to avoid surcharge conditions, for fluctuations in flows due to diurnal variations, and anticipated peak flows. Gravity pipe performance was analyzed based on maximum percent full (d/D ratio), defined as the depth of flow in a pipe divided by the diameter of the pipe.

Table 5-1. City Design and Performance Standards

Pipe Diameter	Maximum Allowed d/D
10-inch and smaller	0.67
12-inch and larger	0.8
Other Design Criteria	
Minimum Diameter	8-inch
Minimum Velocity	2.0 fps
Maximum Velocity	8.0 fps
Manning's Coefficient, n	0.013 for VCP, CIP & DIP, 0.011 for PVC & HDPE

Collection System Flows

Existing and future flows were analyzed in the sewer model for both dry weather and wet weather conditions. Flow rates were derived as described in Chapter 4 of this report. Flow parameters as utilized in this analysis are defined as follows.

- **ADF**: Average daily dry weather system flow
- **PHDWF**: Peak hour dry weather system flow

Collection System Model Development

A hydraulic model of the sewer collection system was developed with the Innovyze® InfoSWMM sewer modeling program. InfoSWMM utilizes Manning's Equation for open channel flow (gravity pipes), Dynamic Wave analysis for flow routing through the collection system, and the Hazen-Williams Equation for pressurized flow conditions (force mains or surcharged pipes). Model results were evaluated for pipeline capacity, flow velocity, and maximum d/D ratio under various flow conditions.

Flow Allocation

Wastewater flows were assigned to the sewer model utilizing estimated flows as described in Chapter 4. Flows were allocated to the closest individual sewer manholes based on the actual location of City customers (existing and future).

Future wastewater flows were allocated to the sewer model based on the location of the parcels in relation to the tributary areas for the modeled manholes. The impact to the collection system from future flows and the proposed land uses, sewer system layout, and demands should be re-evaluated for each project in the planning stage to confirm assumptions made for the purpose of this Sewer Master Plan are accurate and confirm that no additional upgrades will be required.

Model Calibration

The 2016 sewer model was recently created and calibrated, and additional calibration was not warranted for this Master Plan Update. The previously collected sewer flow data and developed hydraulic factors were used to update wastewater flows based on current and future project wastewater flows. Representative data for each flow monitoring location was compared to model results and demand allocations were adjusted to match the flow monitoring results for average daily flow conditions.

System Conditions Analyzed

The hydraulic model was utilized to analyze system flow for both existing and future flow conditions, and including the future flow component from potential future development areas (not currently annexed into the City). Within the model, multiple scenarios were developed that represent these various conditions. Existing and Future scenarios were utilized to identify system upgrades required in order to meet performance criteria as specified, and to identify

areas recommended for high priority maintenance operations. Scenarios developed consist of the following:

- *Existing PHDWF Scenario:* This scenario represents the trunk sewer system under existing peak hour dry weather flow conditions. This scenario includes estimated flow contributions from groundwater infiltration.

- *Future PHDWF Scenario:* This scenario represents the trunk sewer system under future peak hour dry weather flow conditions, with all potential development as described in Chapter 2 contributing to the existing collection system. This scenario includes estimated flow contributions from groundwater infiltration.

Collection System Model Results – Existing Flow Conditions

This section provides a summary of model results for the existing flow conditions modeled.

Deficient System Capacity

The following locations were identified through the analysis as having insufficient capacity to meet City performance standards under existing system flow conditions. Recommended pipe upgrades identified for existing conditions may have the potential to further increase in diameter for future conditions, as described later in this chapter. Thus, when making recommendations to correct existing deficiencies, the future condition must also be considered in the overall recommendation to upsize sewer mains. Refer to Figure 5-1 for a system-wide map showing where existing modeled sewer mains do not meet the maximum d/D criteria under existing PHDWF conditions.

Apple Avenue

- Location Extents: South line between 7th Street (east of El Camino Real) and 9th Street (west of El Camino Real); south line from alley between Tehama Way/5th Street, to alley between 6th and 7th Streets; north line extending from 11th Street easterly to 5th Street; at Freeway 101 crossing.

There are two parallel sewer mains in Apple Avenue, both of which are currently 8-inch VCP and 12-inch VCP. Refer to Figure 5-2 for a detailed overview of the Apple Avenue sewers in this area. Under PHDWF conditions, d/D values up to 1.00 were modeled, thus indicating potential or actual surcharge conditions. In Figure 5-2, preceding the pipe material designations, Pipe numbers corresponding to the summary table of modeled results (Table 5-2) show the flow deficiencies in the individual pipe segments in this area. In addition, actual surcharge and sewer spills have occurred at this location according to the City. It is recommended to upgrade the identified gravity sewer mains to 12-inch PVC (and 18" PVC where indicated) to reduce the maximum d/D to acceptable levels (below 0.8 for upsized 18" and 12" PVC gravity main). **Given this area has a history of surcharging and sewage spills, this sewer upgrade must be performed as soon as possible; new development flows upstream of this area should not be**

allowed to connect until such time this upgrade is completed. In addition, immediately upstream of the Freeway crossing, tie the northerly 12" existing gravity sewer to the existing 21" gravity sewer to improve gravity flow conditions. The existing 12" sewer crossing under the freeway can then be abandoned.

Table 5-2. Flow Deficiencies in Apple Avenue Sewers (Existing Flow Conditions)

ID	Existing PHD d/D	Existing PHD d/D with CIP	Change	Slope (%)	Still Deficient?
58	0.02	0.02	0	0.46	Never Deficient
59	0.02	0.02	0.00	0.43	Never Deficient
57	0.04	0.04	0.00	0.57	Never Deficient
56	0.09	0.09	N/A	0.60	Never Deficient
55	0.16	0.16	0.00	0.32	Never Deficient
26	0.60	0.60	0.00	1.67	Never Deficient
0	0.64	0.60	0.05	1.26	Never Deficient
4	0.40	0.40	0.00	0.83	Never Deficient
25	0.55	0.55	0.00	0.72	Never Deficient
22	0.54	0.54	N/A	0.57	Never Deficient
110	0.75	0.54	0.21	1.18	No
112	1.00	0.57	0.44	0.72	No
21	1.00	0.40	0.60	0.31	No
93	1.00	0.43	0.57	0.19	No
105	1.00	0.31	0.69	0.29	No
8	1.00	0.44	0.56	4.20	No
6	0.45	0.32	0.13	55.11	Never Deficient
24	0.88	0.54	0.34	0.39	No

ID	Existing PHD d/D	Existing PHD d/D with CIP	Change	Slope (%)	Still Deficient?
23	1.00	0.56	N/A	0.51	No
111	1.00	0.53	0.48	0.60	No
106	1.00	0.40	0.61	0.45	No
114	1.00	0.45	0.55	0.40	No
115	1.00	0.38	0.62	0.24	No
40	1.00	0.49	0.51	0.19	No
129	1.00	0.49	0.51	0.15	No
130	1.00	0.65	0.35	0.40	No
20	0.41	0.13	0.27	0.28	Never Deficient
39	0.85	0.41	0.44	0.22	No
94	1.00	0.45	0.55	0.26	No
122	1.00	0.45	0.55	0.26	No
CDT-49	1.00	Abandoned	-	0.27	101 Crossing (12")
38	0.25	0.34	-0.09	0.34	101 Crossing (21")

El Camino Real

- Location Extents: South of Walnut Avenue to Apple Avenue. This existing 10" diameter sewer is deficient if the future tie-in to the 21" gravity sewer crossing beneath Freeway 101, and downstream Apple Avenue upgrades are not completed. If these CIPs are completed, then this deficiency is mitigated. As part of this Master Plan, it is assumed the City will implement these downstream Apple Avenue CIPs and thus mitigate the deficiency in the El Camino Real reach of sewer shown on Figure 5-1.

Vineyard Drive

- Location Extents: Cabernet Avenue to Vineyard Drive Lift Station.

The Vineyard Drive sewer main is currently 10-inch VCP, and the sewer model indicates d/D values up to 1.00 under PHDWF. Upgrading to 12-inch PVC reduces the maximum d/D to acceptable levels (below 0.8) for existing and just over 0.8 for future flow conditions. Because the future maximum d/D is just over 0.8, the City will want to monitor and continue to reassess the capacity of this pipe to determine if further upgrades are necessary. This upgrade requires 780 lineal feet of 12-inch PVC. As part of future upgrades, this sewer is recommended to be upgraded to 18" diameter (only if Pinnacles Development lift station flows are routed through this sewer); thus, this existing CIP upgrade is recommended to be an 18" PVC sewer to anticipate future conditions.

WWTP/Walnut Avenue

- Location Extents: End of 24" line on Walnut Avenue to WWTP headworks .

The sewer main at the WWTP is currently 14-inch and is projected to have a d/D greater than 0.80 under future PHDWF conditions. Upgrading to 24-inch PVC reduces the maximum d/D to acceptable levels. Total affected pipe length is 220 lineal feet. This upgrade may need to be coordinated with future WWTP upgrades recommended in the City's Wastewater Treatment Plant Master Plan.

Low Pipe Velocity

Low pipe velocity results in the increased likelihood for solids to settle out of wastewater flow, leading to pipe backups and blockages. It is recommended to maintain a minimum pipe velocity of 2.0 feet per second (fps) during average flow conditions, to maintain solids in suspension. A total of 45 modeled pipes were identified with a velocity below 2.0 fps under existing average day conditions. This is an improvement from the 2016 master plan where 77 pipes were identified with low velocity. It is recommended that pipes identified with a maximum velocity of less than 2.0 fps be flushed and/or vacuumed on a regular basis. Total length of pipe is 3.2 miles, a 50% reduction in identified sewers from the 2016 sewer master plan. These pipes are depicted in Figure 5-3. These recommendations should be considered for incorporation into the City's SSMP (subsequent update following the 2020 Update) list of high maintenance areas (HMAs).

Pipe Travel Time

Excessive pipe travel time is a result of low velocity and/or long pipe runs, and can lead to problems with hydrogen sulfide attack and odor at downstream manholes. Typically wastewater is oxygenated as it flows through a manhole, decreasing likelihood of hydrogen sulfide generation. Travel time exceeding thirty minutes through a single pipe (manhole to manhole) is undesirable. All pipes included in the hydraulic model have an existing average day travel time of 5 minutes or less; therefore pipe travel time is not anticipated to cause maintenance issues for the City's collection system.

Collection System Model Results – Future Flow Conditions

This section provides a summary of model results for the future flow conditions modeled.

Deficient System Capacity

The following locations were identified through the analysis as having insufficient capacity to meet City performance standards while conveying future system flows. Refer to Figure 5-4 for a system-wide map showing where the collection system does and does not meet maximum d/D criteria under future flow conditions, if the identified existing CIPs are completed. Figure 5-5 shows future deficiencies required, if the identified existing CIPs are NOT completed.

LEGEND

- LIFT STATIONS
- CITY BOUNDARY

DEFICIENCY

- NO
- YES

Note: Deficient is defined as follows:
d/D < 0.67 for pipes less than 12"
d/D < 0.8 for pipes 12" and larger

Cypress Lift Station

Reed Lift Station

Vineyard Lift Station

Nino Lift Station

Los Ositos Lift Station

Tyler Lift Station

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FIGURE 5-1
DEFICIENT GRAVITY SEWER MAINS UNDER EXISTING FLOW CONDITIONS

1 inch = 1,200 feet

N

0 600 1,200

Feet

LIFT STATIONS
EXISTING MANHOLES
8"
10"
12"
14"
18"
21"
24"

Note: Deficient is defined as follows:
d/D < 0.67 for pipes less than 12"
d/D < 0.8 for pipes 12" and larger

Reed Lift Station

49 (PVC)
113 (PVC)
CDT-21 (PVC)
CDT-19 (PVC)
52 (VCP)
51 (VCP)
90 (VCP)
107 (VCP)
3 (VCP)
23 (PVC)
24 (PVC)
25 (VCP)
22 (VCP)
4 (VCP)
0 (VCP)
26 (VCP)
55 (VCP)
5 (VCP)
111 (PVC)
110 (VCP)
114 (PVC)
115 (PVC)
21 (VCP)
93 (VCP)
105 (VCP)
8 (PVC)
40 (VCP)
20 (VCP)
129 (VCP)
39 (VCP)
94 (VCP)
122 (VCP)
CDT-49
98 (HDPE)
9 (PVC)
33 (PVC)

Reed Way
de Leon Dr
de Leon Cir
S el Camino Real
Walnut Ave
10th St
Clifton Ct
Franscioni Dr
Primavera Ct
Apple Ave
Calaveras Way
Madera Ave
Mariposa Cir
Teharna Way
7th St
Acacia Ct
8th St
9th St
10th St
11th St
12th St
5th St
6th St
7th St
8th St
Palm Ave
Oak Ave
Harvest Way
Paloma Way
Paloma Dr
Gavilan Dr
Hutchinson Dr
Chalone Dr
Pinnacles Ave
Larson Ln
Pasque Ave

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FIGURE 5-2
APPLE AVENUE SEWER DETAIL

N
1 inch = 300 feet
0 150 300
Feet

LEGEND

CITY BOUNDARY

ADF MAXIMUM VELOCITY DEFICIENCY?

NO

YES

Greenfield

Where Historic El Camino Real Meets Monterey Wine Country

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Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

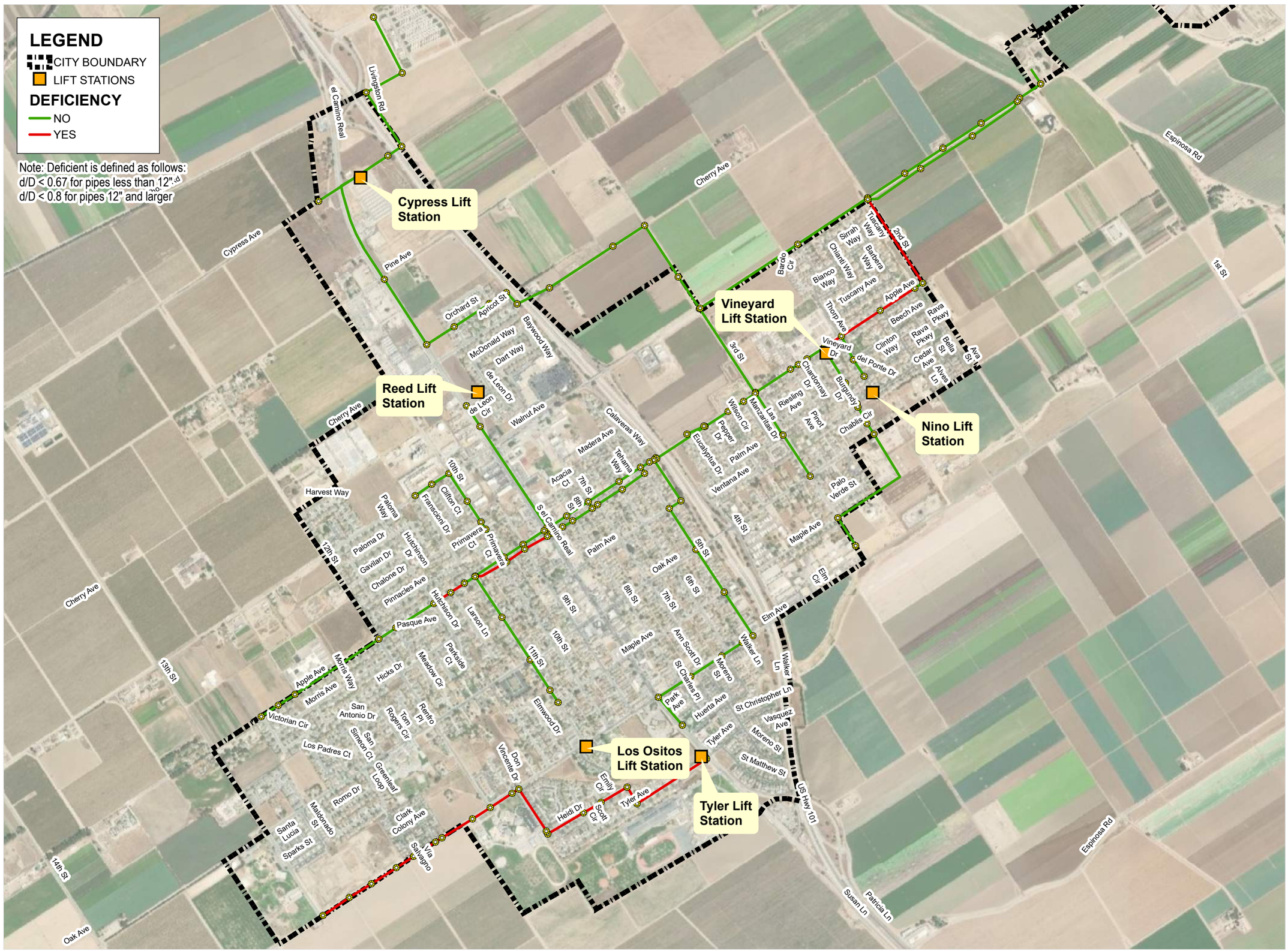
FIGURE 5-3
EXISTING AVERAGE DAILY FLOW MAXIMUM VELOCITY

N

1 inch = 1,200 feet

0 600 1,200

Feet


LEGEND
CITY BOUNDARY
LIFT STATIONS
DEFICIENCY
NO
YES
Note: Deficient is defined as follows:
d/D < 0.67 for pipes less than 12"
d/D < 0.8 for pipes 12" and larger
Cypress Lift Station
Reed Lift Station
Vineyard Lift Station
Nino Lift Station
Los Ositos Lift Station
Tyler Lift Station
Cherry Ave
Cypress Ave
Pine Ave
Orchard St
Apricot St
Baywood Way
McDonald Way
Dart Way
de Leon Dr
de Leon Cir
Walnut Ave
Livingston Rd
el Camino Real
Espinosa Rd
1st St
Barolo Cir
Sirrah Way
Tuscany Way
2nd St
Chianti Way
Barbera Way
Bianco Way
Tuscany Ave
Apple Ave
Thorp Ave
Beech Ave
Rava Pkwy
Vineyard Dr
Clinton Way
del Ponte Dr
Cedar Ave
Bella St
Alves Ln
Ava St
3rd St
Chardonnay Dr
Burgundy Dr
Riesling Ave
Las Manzanitas Dr
Pinot Ave
Chablis Cir
Wilson Cir
Pepper Dr
Eucalyptus Dr
Palm Ave
Ventana Ave
Madera Ave
Calaveras Way
Tehama Way
Acacia Ct
7th St
8th St
4th St
5th St
6th St
7th St
8th St
9th St
10th St
11th St
Oak Ave
Maple Ave
Palo Verde St
Elm Ave
Elm Cir
Walker Ln
Walker Ln
Ann Scott Dr
Moreno St
St Charles Pl
Park Ave
Huerta Ave
St Christopher Ln
Vasquez Ave
Moreno St
Tyler Ave
St Matthew St
US Hwy 101
Emilly Cir
Heidi Dr
Scott Cir
Don Vincente Dr
Elmwood Dr
Primavera Ct
Primavera Ct
S el Camino Real
Hutchinson Dr
Larson Ln
Pasque Ave
Pinnacles Ave
Chalone Dr
Gavilan Dr
Paloma Dr
Hutchinson Dr
Paloma Way
Franciconi Dr
Clifton Ct
10th St
12th St
Harvest Way
Cherry Ave
13th St
14th St
Oak Ave
Apple Ave
Morris Ave
Morris Way
Victorian Cir
Hicks Dr
Meadow Cir
Parkside Ct
San Antonio Dr
Rogers Cir
Tom Ct
Renfro Pl
San Simeon Ct
Los Padres Ct
Greenleaf Loop
Romo Dr
Maldonado St
Santa Lucia
Sparks St
Clark Colony Ave
Via Salvagno
Susan Ln
Patricia Ln
Espinosa Rd
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Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.
THIS MAP IS INTENDED FOR THE EXPRESSED USE OF THE CITY OF GREENFIELD AND DOES NOT CONSTITUTE A LEGAL DOCUMENT. WALLACE GROUP DID NOT PERFORM SURVEY SERVICES FOR THIS MAP. DATA COMPILED FROM MULTIPLE SOURCES.
FIGURE 5-4
DEFICIENT GRAVITY SEWER MAINS UNDER FUTURE FLOW CONDITIONS WITH EXISTING CIP IMPROVEMENTS
1 inch = 1,200 feet
N
0
600
1,200
Feet
M:\1163-Greenfield, City of\008-Water and Wastewater Master Plan Updates\12 - GIS\Figures\Sewer Figures\Fig. 5-4 Future Demand d_D.mxd; Author: <MAP AUTHOR>

LEGEND

CITY BOUNDARY

LIFT STATIONS

DEFICIENCY

NO

YES

Note: Deficient is defined as follows:
d/D < 0.67 for pipes less than 12"
d/D < 0.8 for pipes 12" and larger

Cypress Lift Station

Reed Lift Station

Vineyard Lift Station

Nino Lift Station

Los Ositos Lift Station

Tyler Lift Station

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FIGURE 5-5
DEFICIENT GRAVITY SEWER MAINS UNDER FUTURE FLOW CONDITIONS WITHOUT EXISTING CIP IMPROVEMENTS

1 inch = 1,200 feet

N

0 600 1,200

Feet

As part of future development in the City, at least one new lift station is envisioned, to serve the Pinnacles Development and other development in the south area of the City. The sewer model assumed a location for this lift station in the vicinity of 3rd Street and County Road G16, or further east. In the sewer model, the point of discharge of this force main was assumed to be at 3rd Street north of Elm Avenue. Future gravity sewer upgrade recommendations are based on this assumed lift station force main point of discharge, and should be re-evaluated at the time the lift station for this region is planned.

Apple Avenue East of El Camino Real

- Location Extents: Apple Avenue north line from 5th Street to 7th Street, Apple Avenue from 5th Street to 5th Street Alley.

The sewer main in Apple Avenue is currently 12-inch that is projected to have a d/D greater than 0.80 under future PHDWF conditions. Upgrading to 18-inch PVC reduces the maximum d/D to acceptable levels. Total affected pipe length is 840 lineal feet.

Apple Avenue West of El Camino Real

- Location Extents: Apple Avenue from 2nd Street to Del Ponte Drive (700 LF), 2nd Street from Apple to Walnut Avenue (1,300 LF).

The sewer main in Apple Avenue and 2nd Avenue in this reach is currently 12-inch that is projected to have a d/D greater than 0.80 under future PHDWF conditions. Upgrading to 18-inch PVC reduces the maximum d/D to acceptable levels.

Elm Avenue, Vincente Drive, Heidi Drive, Tyler Avenue to Tyler Lift Station

- Location Extents: Elm Avenue, Heidi Drive to Via Salvgano, Vincente Drive, Heidi Drive, Tyler Avenue to the Tyler Lift Station.

The sewer main in this reach is currently 8-inch that has a d/D greater than 0.67 under future PHDWF. Upgrading to 10-inch PVC reduces the maximum d/D to acceptable levels. Total affected pipe length is 2,300 lineal feet. This upgrade should consider pipeline alignments to accommodate if/when the new Tyler Lift Station is constructed in the future. Before implementing this future CIP, the City can monitor flow conditions to verify if the hydraulic capacity conditions do exist according to the model, and if not, this CIP can be deferred until such time the pipe capacity conditions are realized.

Other Sewer System Considerations

Walnut Avenue, from 2nd Avenue to Near WWTP

- Location Extents: On Walnut Avenue, 2nd Avenue to near the WWTP. On Walnut Avenue, there are two parallel gravity sewers, a 24” and 12” gravity line. These two sewers combine at MH 562, just west of the WWTP. The 12” gravity line comes from the south on 2nd Avenue, then wastewater flows through both the 12” and 24” lines in Walnut Avenue to MH 562. This 24” gravity sewer is capable of conveying the full future wastewater flows with no hydraulic deficiencies (including the future development area

shown on Figure 3-4), all the way to the WWTP (assuming that the last leg of the sewer, the 14" influent line to the headworks, is also upgraded to 24"). The 12" gravity sewer is not essential, and can either be abandoned by the City, or it can remain in service. The City should prioritize video inspection of both this 12" gravity sewer and 24" gravity sewer in the Year 2021, and assess the condition of both sewers. The City can make a decision based on the CCTV results, if the 12" gravity sewer should remain in service, or be decommissioned. If the 12" gravity sewer remains in service, it is likely a gravity line that may need routine inspection and cleaning. However, based on modeled flow results, this 12" sewer appears to be maintaining a good velocity (~5 ft/s). The CCTV inspection can confirm if this sewer is one that may be continued maintenance problems, or is relative free of maintenance issues.

3rd Avenue/Maple Avenue to Vineyard Drive (Future "Pinnacles" Lift Station)

- Location Extents: On 3rd Avenue south of Maple Avenue to Vineyard Drive. The existing 8" gravity sewer in this area is the likely tie-in point for a future sewer force main discharge from the Pinnacles Lift Station. The future development flows will cause this reach of 8" gravity sewer (2,000 LF) to reach capacity at 0.75 d/D. Given that this lift station is not designed yet, the discharge location of the force main could be subject to change. At the time the Pinnacles Lift Station is being designed, a re-evaluation of this potential sewer capacity issue should be re-evaluated. Other than the Pinnacles Development, the future flows from within City limits do not trigger any other gravity sewer upgrades in this area. Direct capacity impacts to the existing gravity sewer system, induced by this future lift station discharge, should be addressed as part of this future Development and lift station. Refer to Chapter 6 regarding potential capacity impacts to the Vineyard Lift Station that may result from the Pinnacles Development.

Apple Avenue Sewer Diversion Analysis

- The City requested Wallace Group to conduct a supplemental analysis of the Apple Avenue sewer upgrades, to see if diverting sewage flow to the north (to Cherry Avenue and El Camino Real) to the existing 24" sewer (at 3rd Street and Walnut Avenue) would be a viable option to alleviate recommended CIPs in Apple Avenue. This analysis is included as Appendix A to this report. Even though some Apple Avenue capital improvement projects may be averted with the construction of a new diversion sewer, the City needs to keep in mind that the reduced flows in the Apple Avenue sewers will reduce line velocities and may increase the level of maintenance and line flushing required over the years to come. In addition, the sewer diversion would require construction of deep gravity sewers for extended lengths, at an estimated cost of $2.35 million, as compared to Apple Avenue sewer repairs that would total less than $1 million.

LEGEND

- LIFT STATIONS
- SEWER MANHOLE
- CITY BOUNDARY

DIAMETER

- 8
- 10
- 12
- 14
- 18
- 21
- 24

Cypress Lift Station

Reed Lift Station

Vineyard Lift Station

Nino Lift Station

Los Ositos Lift Station

Tyler Lift Station

Thorne Rd
Cypress Ave
Pine Ave
Cherry Ave
Harvest Way
Oak Ave
Canal St
14th St
13th St
12th St
10th St
9th St
8th St
7th St
6th St
5th St
4th St
3rd St
2nd St
El Camino Real
Livingston Rd
Espinosa Rd
Orchard St
Apricot St
McDonald Way
Barwood Way
Dart Way
de Leon Dr
de Leon Cir
Walnut Ave
Calaveras Way
Madera Ave
Mariposa Cir
Acacia Ct
Primavera Ct
Palm Ave
Oak Ave
Maple Ave
Elm Ave
Elm Cir
Palo Verde St
Ventana Ave
Eucalyptus Dr
Pepper Dr
Wilson Cir
Manzanitas Dr
Las
Riesling Ave
Chardonnay Dr
Cabernet Ave
Chablis Cir
Vineyard Dr
Clinton Way
del Ponte Dr
Borzini Cir
Thorp Ave
Tuscany Ave
Bianco Way
Chianti Way
Sirrah Way
Tuscany Way
Barbera Way
Barolo Cir
Apple Ave
Beech Ave
Rava Pkwy
Cedar Ave
Bella St
Ava St
Alves Ln
Paloma Way
Fransconi Dr
Clifton Ct
10th St
Primavera
Paloma Dr
Gavilan Dr
Chalone Dr
Hutchinson Dr
Pinnacles Ave
Pasque Ave
Larson Ln
Parkside Ct
Meadow Cir
Hicks Dr
Morris Way
Morris Ave
Victorian Cir
San Antonio Dr
Rogers Cir
Tom
Renfro Pl
San Simeon Ct
Los Padres Ct
Greenleaf Loop
Romo Dr
Maldonado St
Santa Lucia
Sparks St
Clark Colony Ave
Via Salvagno
Don Vincente Dr
Elmwood Dr
Heidi Dr
Scott Cir
Emily Cir
Tyler Ave
Huerta Ave
Park Ave
St Charles Pl
Ann Scott Dr
Moreno St
Walker Ln
St Christopher Ln
Vasquez Ave
St Matthew St
US Hwy 101
Susan Ln
Patricia Ln

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FIGURE 5-6
FUTURE CIP DIAMETER

N

1 inch = 1,200 feet

0 600 1,200

Feet

6: Evaluation of Sewage Lift Stations

The City of Greenfield owns and operates six sewage lift stations as part of the City's overall sewage collection system. All six lift stations are Smith & Loveless wetpit/drypit lift stations. This section provides a detailed evaluation of each of the six lift stations. The lift stations are evaluated from a general operational standpoint, and then from a hydraulic/operations standpoint. These lift stations and corresponding tributary areas are depicted on Figure 2-2 in Chapter 2. Details of the hydraulic capacity, equipment and other details of the lift stations will be provided later in this Chapter. Refer to Chapter 5 for a discussion on the future "Pinnacles" lift station that will be required in the future to serve the Pinnacles Development and other development in the southern region of the City.

Lift Station General Evaluation (non-hydraulic)

The six lift stations were evaluated based on non-hydraulic parameters. This evaluation included review of existing information, as-built drawings, and a site visit to each lift station with City staff on December 3, 2020. A summary of the pertinent non-hydraulic parameters of the lift stations is presented in Table 6-1.

In general, if/when lift stations must be replaced in the future, it is recommend that the City consider submersible pumps/lift stations with no drypit. From a serviceability and safety standpoint, these types of lift stations are easier to maintain, and do not require confined space entry for pump retrieval. Confined space entry procedures would be required only if needing to work within the wetwell itself.

Tyler Lift Station

Tyler Lift Station is located at the intersection of El Camino Real and Tyler Avenue. The lift station services the portion of the City to the south of Elm Avenue and west of Highway 101. The lift station discharges through a 6-inch diameter PVC force main to a manhole near the intersection of Huerta Avenue and El Camino Real.

Tyler Lift Station

Lift Station/Pumps: The lift station has a wetwell with suction piping and a drypit that houses the two pumps and valving. The lift station was installed in 1990 with two 10-hp pumps and was upgraded in 2007 with two new 20-hp pumps. According to City staff, this upgrade to 20-hp pumps maximizes the space within the drypit area, thus larger pumps cannot be accommodated in the existing drypit if needed in future years. The lift station is equipped with a dedicated diesel generator (200 gallon capacity). The generator is of appropriate size to run the lift station pumps during a power outage; however, upon initial startup of the generator and

pumps, the in-rush current from the pumps trips the breaker and the City must respond to manually turn activate standby power during a power outage. Depending on timing of an outage, response time by City staff could be very critical. The pumps were recently equipped with non-clog impellers to help minimize clogs from rags and other debris. In addition, in 2018, the check valves to the pumps failed and were replaced. Also recently the existing backup float switches in the wetwell were replaced.

Wetwell: The wetwell is a circular unlined concrete wetwell. The wetwell is in good condition, with no visible signs of corrosion.

Site Conditions: The lift station site area is paved and fenced, with a driveway/access off of El Camino Real, a busy thoroughfare. Hatches are padlocked for security. There is good drainage in the area, and the site is not prone to flooding. The site has lighting for night-time emergency maintenance and there is potable water available for sanitation and washdown purposes.

Table 6-1. Summary of Lift Station Conditions (Non-Hydraulic)

	Tyler	Los Ositos	Vineyard
Year Built	1990	1979	1983
Lift Station Type	Smith and Loveless - Wet Pit/Dry Pit	Smith and Loveless - Wet Pit/Dry Pit	Smith and Loveless - Wet Pit/Dry Pit
Standby Power	Yes	No, quick connect.	No, quick connect.
Electrical Service	Unknown	Unknown	Unknown
Alarms	Known Problems	Good[a]	Good
Wetwell Material	Concrete	Concrete	Concrete
Wetwell Coating	No	No	No
Wetwell Condition	Good	Good	Deteriorating in manway, unable to see lower.
Site Drainage	Good	Good	Good
Potable Water at Site	Yes	No	No
Site Lighting	Yes	No, street lights nearby.	No, street lights nearby.
Site Security/Fencing	Yes	No	Yes

[a]City should monitor tree growth in the area as it relates to radio transmission for lift station alarms.

	Nino	Reed	Cypress
Year Built	2004	1985	2004
Lift Station Type	Smith and Loveless - Wet Pit/Dry Pit	Smith and Loveless - Wet Pit/Dry Pit	Smith and Loveless - Wet Pit/Dry Pit
Standby Power	Yes	No, quick connect.	No, quick connect.
Electrical Service	Unknown	Unknown	Unknown
Alarms	Good	Good	Good
Wetwell Material	Concrete	Concrete	Concrete
Wetwell Coating	No	No	Yes
Wetwell Condition	Good	Good	Good
Site Drainage	Good	Good	Good
Potable Water at Site	No	No	Yes
Site Lighting	No, street lights nearby.	No	Yes
Site Security/Fencing	Yes	Yes	Yes

Los Ositos Lift Station

The Los Ositos Lift Station is located at the intersection of 11th Street and Elm Avenue. The lift station services the Los Ositos residential development on Elm Avenue near the intersection of Elm Avenue and 11th Street, comprised of approximately 50 units. The lift station discharges through a 6-inch diameter PVC force main to a manhole near the intersection of 11th Street and Maple Avenue.

Lift Station/Pumps: The lift station has a wetwell with suction piping and a drypit that houses the two pumps and valving. The lift station has two 3-hp pumps and was installed in 1979.

Los Ositos Lift Station

Wetwell: The wetwell is a circular concrete wetwell with tar around the manway portion to prevent root intrusion from the tree adjacent to the lift station. Small roots were observed penetrating the seams of the manway rings at the time of the site visit. Large roots from the adjacent tree was also observed extending around the wetwell, although no large root penetration was noted in the wetwell or manway. The wetwell is in good condition, with no visible signs of corrosion however the manway was noted to be in fair condition with some concrete deterioration.

Site Conditions: The lift station is in a grassy area near Elm Avenue and is open (not fenced), with vehicle access for maintenance. Hatches are padlocked for security. The lift station is situated between two multi-family residential areas on the south side of Elm Avenue, with walkways on both sides of the station. There is good drainage in the area, and the site is not prone to flooding. The site does not have lighting for night-time emergency maintenance and there is not potable water available for sanitation and washdown purposes.

Vineyard Lift Station

The Vineyard Lift Station is located on a dedicated lot on Vineyard Avenue, south of Apple Avenue, "sandwiched" between residential development on two sides. The lift station services portions of the City south of Apple Avenue and north of Elm Avenue and between Las Manzanitas Drive to the west and Alves Lane to the east. The lift station discharges through a 4-inch diameter PVC force main to a manhole to the northwest of the lift station in Apple Avenue.

Vineyard Lift Station

Lift Station/Pumps: The lift station has a wetwell with suction piping and a drypit that houses the two pumps and valving. The lift station has two 3-hp pumps and was installed in 1983. The City experiences pump clogging occasionally (approximately every 2 weeks); the City should consider equipping the pumps with non-clog impellers.

Wetwell: The wetwell is a circular concrete wetwell with no coating. There are noticeable signs of deterioration in the manway, but due to access constraints the condition of the wet well below the manway is unknown.

Site Conditions: The lift station is in a dirt lot between Apple Avenue and Vineyard Drive near Elm Avenue and is fenced, with vehicle access for maintenance. Hatches are padlocked for security. There is good drainage in the area, and the site is not prone to flooding. The site does not have lighting for night-time emergency maintenance and there is not potable water available for sanitation and washdown purposes.

Nino Lift Station

Nino Lift Station

The Nino Lift Station is located at the intersection of Nino Lane and Del Ponte Drive. The lift station services portions of the City south of Apple Avenue and north of Oak Avenue and between Las Ava Street to the west and Del Ponte Drive to the east. The lift station discharges through a 4-inch diameter PVC force main to a manhole to the northwest of the lift station near the intersection of Del Ponte Drive and Nino Lane.

Lift Station/Pumps: The lift station has a wetwell with suction piping and a drypit that houses the two pumps and valving. The lift station has two 3-hp pumps and was installed in 2004. The lift station has a dedicated generator on-site. The pumps were recently equipped with non-clog impellers, and one pump volute was replaced.

Wetwell: The wetwell is a circular concrete wetwell with no coating. The wetwell is in good condition, with no visible signs of corrosion. The wetwell has a large diameter (36”) manhole lid that requires two operators to open, and is still very heavy for two staff to lift/remove.

Site Conditions: The lift station is in a residential neighborhood, fenced, with vehicle access for maintenance. The wetwell is located outside of the fenced area in Del Ponte Drive. Hatches are padlocked for security. There is good drainage in the area, and the site is not prone to flooding. The site does not have lighting for night-time emergency maintenance and there is not potable water available for sanitation and washdown purposes.

Reed Lift Station

The Reed Lift Station is located near the intersection of Reed Lane and De Leon Drive. The lift station services portions of the City south of Apricot Avenue and north of Walnut Avenue and between Highway 101 to the west and El Camino Real to the east. The lift station discharges through a 6-inch diameter PVC force main to a manhole near the intersection of Reed Way and El Camino Real.

Reed Lift Station

Lift Station/Pumps: The lift station has a wetwell with suction piping and a drypit that houses the two pumps and valving. The lift station has two 3-hp pumps and was installed in 1985. The lift station is equipped with a generator connection for mobile backup power when needed.

Wetwell: The wetwell is a circular concrete wetwell with no coating. The wetwell is in good condition, with no visible signs of corrosion.

Site Conditions: The lift station is paved and is fenced, with vehicle access for maintenance. Hatches are padlocked for security. There is good drainage in the area, and the site is not prone to flooding. The site does not have lighting for night-time emergency maintenance and there is not potable water available for sanitation and washdown purposes.

Cypress Lift Station

The Cypress Lift Station is located near the intersection of Cypress Avenue and El Camino Real. The lift station services portions of the City north of Cypress Avenue, and specifically the Yanks Development. The lift station discharges through a 10-inch diameter PVC force main to a manhole near the intersection of Pine Avenue and El Camino Real.

Cypress Lift Station

Lift Station/Pumps: The lift station has a wetwell with suction piping and a drypit that houses the two pumps and valving. The lift station has two 20-hp pumps and was installed in 2004. The lift station is equipped with a generator receptacle for mobile generator power during an outage.

Wetwell: The wetwell is a circular concrete wetwell with a protective coating. The wetwell is in good condition, with no visible signs of corrosion. The two wetwell lids are similar to the Nino Lift Station in that they are large diameter (36") and very heavy for operators to remove and replace.

Site Conditions: The lift station is paved and is fenced, with vehicle access for maintenance and the wetwell is located outside of the fenced area. Hatches are padlocked for security. There is good drainage in the area, and the site is not prone to flooding. The site does not have lighting for night-time emergency maintenance and there is not potable water available for sanitation and washdown purposes.

Lift Station Hydraulic Performance Evaluation

The hydraulic characteristics of each lift station were analyzed and deficiencies were noted. Design criteria that apply to the lift stations and force mains are summarized below. Table 6-2 summarizes the hydraulic parameters of each lift station.

- Force main velocities should be greater than 2.0 feet per second to maintain self-cleansing properties but less than 5.0 feet per second to minimize head loss and water hammer.
- Lift stations should be able to convey peak flows with the largest pump out of service. Station "capacity" is therefore calculated with the largest pump out of service.
- Lift station wet wells should be sized to limit the number of pump starts per hour to acceptable limits as defined by the pump manufacturer. Traditionally this is in the range of 6 starts per hour on average, or less.
- Lift stations should have a means of conveying peak flows during a power outage. Lift stations serving a small number of customers could use wet well storage to meet this requirement.

Lift Station Flows

This subsection describes details of the existing lift stations and tributary flows (existing and future) relative to the pumping capacities of the existing lift stations. A comparison of existing and future flows to each lift station is shown in Table 6-3. . In general, an 8% to 10% reduction in existing tributary wastewater flows was seen at each lift station. This observation is likely due to continued water conservation efforts throughout the City. Future flows are indicative of Year 2040 build-out. The most notable future wastewater flow increase is at the Vineyard Lift Station, which will need to accommodate flows from the Pinnacles Development. The Cypress Lift Station projected flows are based on future build-out flows estimated for The Yanks Development. Flow parameters for each lift station are summarized in Table 6-4.

The peak hour wet weather flow is calculated as follows:

The average wastewater flow is multiplied by the diurnal peaking factor measured during the flow monitoring described previously, to obtain peak hour flow (dry weather).

Table 6-2. Summary of Hydraulic Characteristics

Lift Station		Tyler	Los Ositos	Vineyard
Pump Type		Vertical Non-Clog	Vertical Non-Clog	Vertical Non-Clog
Pump Manufacturer/Model		Smith & Loveless, Model 4C2A	Smith & Loveless, Model 4B2A	Smith & Loveless, Model 4B2A
No. of Pumps		2	2	2
Pump Motor HP		20	3	3
Motor Speed, RPM		1800	1170	1170
Date of Last Pump Upgrade/Overhaul		2007	N/A	N/A
Design Flow/Head (GPM@TDH)		600 GPM @ 80' TDH	450 GPM @ 17' TDH	140 GPM @ 25' TDH
Pump Design Flow Condition		Simplex	Simplex	Simplex
Approximate Pump Operating Efficiency at Design Point, %		70	70	45
Wet Well Diameter		6	6	6
Wet Well Depth		31	15.66	24
Operating Depth (ft)	**High (Pump On)**	6.50	4.00	7.00
	Low (Pump Off)	2.00	3.00	4.00
Wetwell Operating Volume, Gallons[1]		952	211	441
Force Main Diameter, Inches		6	8	4
Force Main Material		PVC	PVC	PVC
Force Main Velocity, ft/s, Simplex		2.20	1.59	1.65

[1]*Wetwell operating volume calculated based on existing operational set points.*

Table 6-2, Summary of Hydraulic Characteristics (Continued)

Lift Station		Nino	Reed	Cypress
Pump Type		Vertical Non-Clog	Vertical Non-Clog	Vertical Non-Clog
Pump Manufacturer/Model		Smith & Loveless, Model 4B2	Smith & Loveless, Model 4B2A	Smith & Loveless, Model 6C4C
No. of Pumps		2	2	2
Pump Motor HP		3	3	20
Motor Speed, RPM		1200	875	1200
Date of Last Pump Upgrade/Overhaul		N/A	N/A	N/A
Design Flow/Head (GPM@TDH)		180 GPM @ 25' TDH	200 GPM @ 19' TDH	1000 GPM @ 42' TDH
Pump Design Flow Condition		Simplex	Simplex	Simplex
Approximate Pump Operating Efficiency at Design Point, %		55	70	65
Wet Well Diameter		6	4	8
Wet Well Depth		20	22.33	30
Operating Depth (ft)	**High (Pump On)**	6.75	5.50	1.50
	Low (Pump Off)	4.50	3.25	1.00
Wetwell Operating Volume, Gallons[1]		330	211	188
Force Main Diameter, Inches		4	6	10
Force Main Material		PVC	PVC	PVC
Force Main Velocity, ft/s, Simplex		3.12	1.73	4.08

[1]*Wetwell operating volume calculated based on existing operational set points.*

Force Main Velocities

For three of the six lift stations (Tyler, Nino and Cypress), the force main velocities under simplex pump mode are within generally accepted criteria for self-cleansing and for minimizing headloss. The remaining three lift stations (Los Ositos, Vineyard and Reed) have force main velocities under simplex pump mode that are below generally accepted criteria for self-cleansing and for minimizing headloss. It is recommended that these force mains be maintained on a regular basis by occasionally running the pump station in duplex mode to increase the force main velocity, or otherwise making sure the force mains remain clear of solids accumulations.

Table 6-3. Summary of Existing and Future Lift Station Tributary Flows

Lift Station	Existing Flows (ADD)		Future Flows (ADD)	
	gpm	mgd	gpm	mgd
Cypress	17.9	0.03	88.6	0.13
Tyler	118.8	0.17	168.3	0.24
Vineyard	47.1	0.07	170.8	0.25
Nino	17.9	0.03	17.9	0.03
Reed	12.5	0.02	12.5	0.02
Los Ositos	4.5	0.01	4.5	0.01

Table 6-4. Summary of Lift Station Flows

Lift Station	Tyler	Los Ositos	Vineyard	Nino	Reed	Cypress
Existing Average Daily Flow, gpd	171,072	6,480	67,824	25,776	18,000	25,776
Existing Average Daily Flow, gpm	119	5	47	18	13	18
Peaking Factor	2	2	2	2	2	2
Existing Maximum Day Flow, gpm	238	9	94	36	25	36
Future Average Daily Flow, gpd	242,410	6,480	245,866	25,776	18,000	127,526
Future Average Daily Flow, gpm	405	5	121	18	13	103
Future Maximum Day Flow, gpm	810	9	242	36	25	207
Lift Station Design Capacity, gpm, Simplex	600	450	140	180	200	1,000
Lift Station Tested Capacity, gpm, Simplex[1]	193	249	64	122	153	1,000

[1]Tested lift station capacity was calculated using the time required to run a full pump down cycle (i.e., between the high and low operational set points) and does not account for inflow into the wetwell during the test. Therefore, flows calculated based on this testing methodology are most likely lower than the actual flow. This field test was conducted as part of the 2016 Sewer Collection System Master Plan.

Tyler Lift Station

The Tyler Lift Station has a design capacity of 600 gpm but a field tested operating capacity of 193 gpm. Considering the design operating flow, the lift station is adequately sized to meet existing peak hour flow conditions with one pump running but will not have adequate capacity to meet future peak hour flow conditions. Although the design operating flow appears adequate, based on recent observations, the lift station does occasionally need to run both pumps to keep up with peak hour flows. Identified issues include:

- The City has had difficulty with operating the lift station since the pumps were upgraded to 20 HP in 2007 and the new pumps do not seem to fit perfectly with the existing lift station configuration.
- The existing lift station physically cannot handle larger pumps than the existing 20 HP pumps; thus the lift station pumping capacity cannot be increased.
- The generator at the site is not rated large enough to handle the startup amperage draw from the pumps when there is a power failure. When there is a power outage, the auto-transfer switch to the generator "trips", triggers an alarm, and the pumps do not run. When this happens, City staff has to manually turn the generator back on to allow the pumps to run.
- The two gate valves and the check valve on pump #1 were not functional in 2016; however, the City repaired/replaced the check valve in 2018.

Due to the occasional capacity issues at existing peak hour flow, and future capacity deficiency and the items identified above, it is recommended that the City consider a full replacement of the Tyler lift station with a new triplex submersible lift station. A suitable location may be at or near the adjacent Park, away from the existing busy intersection. This lift station upgrade/replacement should be considered within the next 5 years.

Los Ositos Lift Station

The Los Ositos Lift Station has a design capacity of 450 gpm but a field tested operating capacity of 249 gpm. Based on existing and future peak hour flows, and despite the lower field tested pumping capacity noted, the lift station will be capable of pumping existing and future peak hydraulic flow in Simplex mode of operation. The City should continue to monitor the force main and ensure it does not accumulate solids due to low velocities.

Vineyard Lift Station

The Vineyard Lift Station has a design capacity of 140 gpm but a field tested operating capacity of 64 gpm. Considering the design operating flow, the lift station has adequate capacity to meet the existing peak hour flow conditions with one pump running but would also have adequate capacity to meet future peak hour flow conditions should the Pinnacles Development flows not be received through this lift station. IF/when the Pinnacles Development occurs, this lift station will require upgrades. There is ample room on the existing lift station site to increase wetwell volume and pumping capacity. If the existing drywell pumps cannot be upsized to

accommodate future flows from the Pinnacles Development, it would be recommended that the City consider the upgrade to include new submersible pumps, and mothballing the drypit pumps which require confined space entry for repair/maintenance. This lift station upgrade would be directly attributable to the Pinnacles Development and its corresponding future flows.

Nino Lift Station

The Nino Lift Station has a design capacity of 180 gpm but a field tested operating capacity of 122 gpm. Considering the design operating flow, the lift station has adequate capacity to meet both existing and future peak hour flow conditions with one pump running.

Reed Lift Station

The Reed Lift Station has a design capacity of 200 gpm but a field tested operating capacity of 153 gpm. Considering the design operating flow, the lift station has adequate capacity to meet both existing and future peak hour flow conditions with one pump running.

Cypress Lift Station

The Cypress Lift Station has a design capacity of 1,000 gpm. Considering the design operating flow, the lift station has adequate capacity to meet both existing and future peak hour flow conditions with one pump running. This lift station is over-sized, and recommendations to address this will be provided later in this section.

Lift Station Wetwell Capacity

The lift station volumes were calculated, and pump cycle times were computed for each station, based on average day and peak hour flows (running in simplex mode). Cycle times were not able to be computed for the wetwells in duplex mode, as duplex curves were not available. Table 6-5 summarizes the wetwell cycle time calculations. It is noted that lift station volumes can also vary depending on pump on/off setpoints, especially the larger lift stations such as the Cypress Lift Station.

Lift station pumps should typically cycle not more than 5 to 6 times per hour at average flow conditions, to limit pump starts. This recommendation, however, should be based on the actual pump manufacturer's information. Pump motors and starters have improved significantly over the years, and thus can withstand more frequent starts than in years past. Pump cycling in excess of the manufacturer's recommendation can lead to increased wear and tear, increased maintenance requirements and premature pump failure. If pumps do not cycle frequently enough (as in the case of the Cypress Lift Station), raw sewage is allowed to sit in the wetwell for longer, increasing the likelihood of off-gassing and sulfuric acid attack to the wetwell.

Table 6-5. Summary of Lift Station Cycles per Hour

	Tyler	Los Ositos	Vineyard	Nino	Reed	Cypress
Wetwell Operating Volume, gallons	952	211	441	330	211	1316
Cycles per Hour at Existing ADF	6.0	1.3	4.3	2.9	3.3	0.8
Cycles per Hour at Existing MDF	9.0	2.5	4.2	5.2	6.2	1.6
Cycles per Hour at Future ADF[2]	8.3	1.3	2.2	2.9	3.3	4.2
Cycles per Hour at Future MDF[1,2]	---[1]	2.5	---[1]	5.2	6.2	7.5[2]

[1]*MDF exceeds current pump flow rate in simplex mode.*

[2]*Cypress lift station is currently using a small portion of the total wetwell capacity. Therefore, the calculated number of cycles per hour shown in this table for future flow conditions are higher than they would be if the full wetwell capacity was in use. It is anticipated that the City will adjust the operating levels of the wetwell as the ADF and MDF increase in the future.*

Tyler Lift Station

Although the Tyler lift station has a relatively large operating volume, it appears to be undersized, causing the pumps to cycle too frequently under existing peak hour and future average day conditions. Under future peak hour conditions, the inflow rate exceeds the outflow rate. This is consistent with feedback from City operations staff. Capital improvement recommendations related to the Tyler lift station are included in the next section.

Los Ositos Lift Station

Although the Los Ositos lift station has a relatively small operating volume, it appears to be oversized, causing the pumps to cycle too infrequently under all conditions. It is recommended that the City assess the feasibility of adjusting pump on/off levels to marginally decrease the operating volume.

Vineyard Lift Station

The Vineyard lift station pumps and wetwell operating volume fall within expected recommended cycle frequency and times, and is adequate for future flow conditions if the Pinnacles Development does not occur. If/when the Pinnacles Development takes place, this lift station will likely need to be upgraded, including adding wetwell volume/capacity and replacing the drypit pumps with new submersible pumps.

Nino Lift Station

The Nino lift station appears to be properly sized based on the current operating volume for conditions analyzed.

Reed Lift Station

The Nino lift station appears to be properly sized based on the current operating volume for conditions analyzed.

Cypress Lift Station

The operating volume for the Cypress lift station can vary significantly given the size of the wetwell and the ability to adjust pump on/off levels. The lift station has a very large wetwell with adequate capacity to accommodate increased flows. The wetwell is too large however, for current flows, thus even with adjusting the wetwell operating volume, wastewater tends to sit in the wetwell for extended periods of time and turn septic. This has the potential to cause significant sulfide build up in the wetwell, cause potential odor problems, and create these same problems downstream of the lift station and force main. It is also noted that the City is receiving "blue waste" from the RV Park, and this will exacerbate the quality of raw wastewater that must pass through this wetwell on to the treatment plant. The City should consider the following recommendations to address the Cypress Lift Station:

- Reduce the horsepower/size of the pumps.
- Adjust operating levels to increase pump cycle times and detention time of the raw sewage in the wetwell.
- If reducing the horsepower/size of the pumps does not fully address the concerns described above, compartmentalize the wetwell to reduce its volume, leaving half of the wetwell reserved only for emergency storage. This will ensure better throughput of sewage from the wetwell and keep wastewater fresher. This may be challenging however, as it creates a maintenance problem to maintain this vacant portion of wetwell, and to clean it out if/when it is used for emergency storage.

Lift Station Capital Improvements

Recommended capital improvements with corresponding capital costs are presented in Chapter 8. A summary of the recommended capital improvements and their justification is included in this section.

Tyler Lift Station

Capital Improvements:

- Priority 1: Implement electrical upgrades/repairs to the generator/connection, to remedy the issue of the breakers tripping during emergency power startup.
- Priority 1: Replace the lift station with either a new triplex wet pit/dry pit lift station or a triplex submersible pump station with self-cleaning wetwell, with shallow valve vault

(eliminates confined space entry, except for any future wetwell interior repairs), and with sufficient hydraulic capacity/redundancy to meet future peak flows in the simplex mode of operation. This new station could be located in the City's nearby park located to the west on Tyler Avenue. It is recommended that this Project be implemented within the next 5 years.

Operational Considerations:

- None.

Los Ositos Lift Station

Capital Improvements:

- Priority 1: None.
- Priority 2: Consider protective lining for the wetwell to enhance longevity.
- Priority 2: Evaluate the need for replacing existing pump impellers with non-clog impellers.

Operational Considerations:

- Flush clean the 8" force main occasionally to ensure solids do not accumulate in the force main (due to low velocities and long detention time).
- Monitor root intrusion in the manway, and continually remove roots to prevent concrete cracking. Monitor potential for large root penetration due to adjacent large tree.
- Inspect and evaluate the existing pumps (original pumps installed in 1979) and implement scheduled maintenance and repairs as needed.

Nino Lift Station

Capital Improvements:

- Priority 1: None.
- Priority 2: Consider protective lining for the wetwell to enhance longevity.

Operational Considerations:

- Inspect and evaluate the existing pumps (original pumps installed in 2004) and implement scheduled maintenance and repairs as needed.

Reed Lift Station

Capital Improvements:

- Priority 1: None.
- Priority 2: Consider protective lining for the wetwell to enhance longevity.
- Priority 2: Evaluate the need for replacing existing pump impellers with non-clog impellers.

Operational Considerations:

- Inspect and evaluate the existing pumps (original pumps installed in 1985) and implement scheduled maintenance and repairs as needed.

Vineyard Lift Station

Capital Improvements:

- Priority 1: Repair/replace deteriorating concrete manway to the wetwell.
- Priority 2: Consider protective lining for the wetwell to enhance longevity, particularly if existing wetwell will continue in service as part of future lift station upgrade (due to Pinnacles Development).
- Future: The recommendation to upgrade the Vineyard Lift Station is not identified as a CIP, as this upgrade will be necessary only if/when the Pinnacles Development occurs.

Operational Considerations:

- Inspect and evaluate the existing pumps (original pumps installed in 1983) and implement scheduled maintenance and repairs as needed.

Cypress Lift Station

Capital Improvements:

- Priority 1: None.

Operational Considerations:

- Test the adequacy of the existing portable generator to power the existing lift station pumps during a power outage. If the portable generator is insufficient or incapable of providing backup power, make provisions for backup power as recommended by an electrical engineer.
- Continue to evaluate lift station flows and pump cycle times, adjust operating levels to increase pump cycle times to match incoming flows.

7: Capital Improvement Projects

This Chapter presents the proposed Capital Improvement Projects (CIP), with a brief description of the proposed projects and a preliminary cost estimate for each proposed improvement for the City of Greenfield (City).

Basis of Capital Improvement Program Costs

The CIP costs were developed based on engineering judgment, confirmed bid prices for similar work in the area, consultation with vendors and contractors, established budgetary unit prices for the work, and other reliable sources. Hard construction costs are typically escalated by a factor of 1.4, to allow budget for "soft costs" that include preliminary engineering, engineering, administration, construction management and inspection costs. Some projects may have factors other than 1.4 depending on project type. All CIP costs are expressed in August 2020 dollars, using McGraw-Hill ENR Construction Cost Index of **11455**, and will need to be escalated to the year or years scheduled for the work. The unit cost for new gravity sewers includes the proposed pipelines, manholes, lateral re-connections, sewer bypassing, traffic control, etc., and all other aspects of sewer system construction. Table 7-1 provides an overview of unit costs used for the construction of new replacement sewers in the City of Greenfield. Note, this table does not apply to new construction where sewers may be constructed in areas prior to construction of public roads.

Table 7-1. Unit Costs for Construction of Gravity Sewer Mains

Size (Inches)	Replacement Material	Replacement Cost per Linear Foot (Year 2020)
8	PVC	$200
12	PVC	$225
16	PVC	$250
18	PVC	$275

[1] All pipes are SDR 35 PVC unless otherwise stated.

Timing of Recommended Improvements

There are some projects triggered by existing deficiencies and some projects triggered by future development. The existing deficiencies are considered near-term projects, and are recommended to be completed within the next 10 years. Capital projects that are necessary as a direct result of future development, are not listed as part of this CIP, rather these identified projects are expected to be employed by the Developer at the time the Development occurs. These projects include:

1. Vineyard Lift Station Upgrade (only needed if/when Pinnacles Development takes place).

2. 3rd Street/Maple Street Sewer Upgrade, Replace 2,000 LF of 8" gravity sewer with 10" gravity sewer (only needed if/when Pinnacles Development takes place).
3. Vineyard Drive Sewer Upgrade to 12" or 18" diameter. If/when the Pinnacles Development occurs, the upgrade to 18" diameter will in part be attributed to the Pinnacles Development. If the Development does not occur, the City's existing 10" sewer may be adequate, but will require monitoring in the future to determine if an upgrade to 12" diameter is warranted.

High Priority CIP

There is a group of CIPs slated for high priority and near-term initiation. On Apple Avenue, between 7th and El Camino Real, the City has experienced recent sewer surcharging and spills in this area, as reported in the State CIWQS system. This condition has also been confirmed in the sewer model. The City should immediately implement CIP 1-5, which replaces a 12" diameter "bottle-neck" to 18" diameter. This initial CIP on Apple Avenue will reduce pipe flow depths (d/D) through a larger reach upstream of this location, thus relieving flow conditions in this reach. Other Apple Avenue CIPs still must be implemented following this initial work. This initial CIP-5 should be completed before any upstream new service connections are allowed service. After implementation of CIP-5, then CIPs 1-1 and 1-6 should be implemented, followed by CIP 1-2.

There are also projects that are triggered by potential future development, for which timing is difficult to ascertain. These long-term projects are listed in no particular order as they will be prioritized based on timing and location of future development. Also note the discussion in the above paragraph regarding Projects that are directly attributable to future Developments.

Table 7-2 provides a summary of all the existing recommended CIPs, or Near Term Projects, and includes an estimate of the construction and "soft" costs for each project. Table 7-3 provides a summary of the future recommended CIPs, or Long Term Projects, and their estimated costs. Figure 7-1 through 7-4 depict the locations of capital improvement projects throughout the City.

Sewer Collection System Operation and Maintenance

In order to maintain the City's sewer collection system assets, the City establishes an annual O&M budget that must cover many aspects of the sewer system on-going O&M. There are many things that the City should do to properly maintain the sewer system components, and this should be coordinated with other requirements outlined in the City's Sewer System Management Plan (SSMP) that include in-line videos, sewer jetting/cleaning, manhole inspection and cleaning, root abatement and other requirements, including all other requirements to address the City's six sewer lift stations. The recommended budget for O&M varies widely with the type of facilities, number and size of facilities, age and condition of existing facilities. The City should start by assessing their current O&M budget and verify if it is adequate or not for continued and on-going O&M. The City has six sewer lift stations, and miles

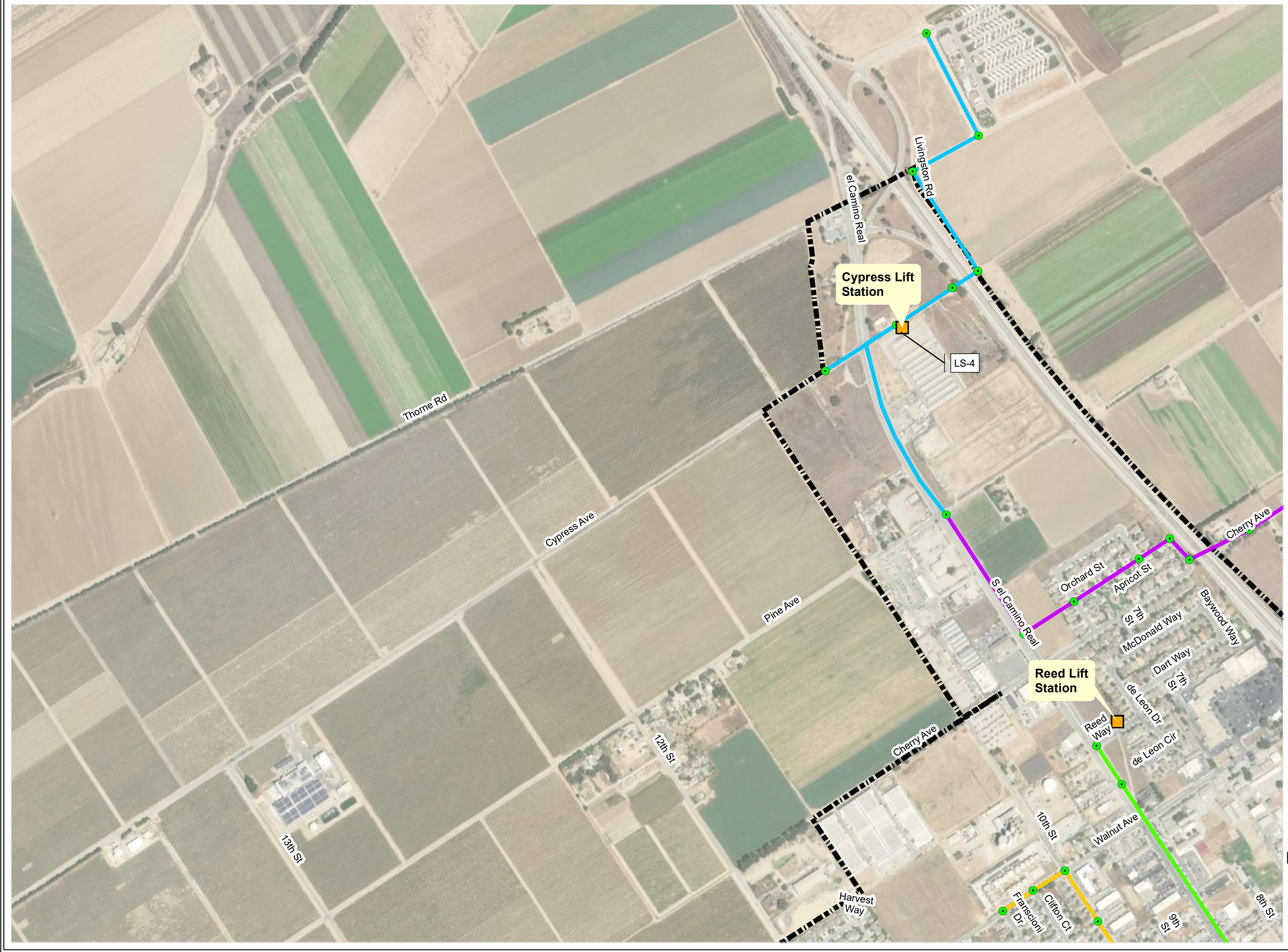
of gravity and force main sewer pipe, and associated sewer manholes. The City should review O&M manuals for all mechanical equipment such as lift station pumps and associated equipment, including electrical, standby generators, wetwells, and all related system components. This will include keeping careful track of maintenance schedules and other service requirements, and keeping common replacement parts on hand. The City's budget should be based on prior historical experience coupled with anticipating on-going needs for their inventory of assets. This should include a program for servicing and replacing lift station pumps, maintaining condition of wetwells and manholes for protection against corrosion/sewer gases, line flushing and video inspection, and other items. The budget for O&M is beyond the scope of this master plan and capital improvement program, but the City should assess their current O&M budget for the sewer fund and continue to assess on-going sewer system O&M needs. Maintaining and keeping accurate records of costs and labor requirements year after year will assist the City in keeping annual O&M budgets sufficient for changing needs from year to year.

Table 7-2: Existing CIPs

Project #	Title	Description	Quantity	Length (ft)	Existing Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Total Project Cost ($)
1-1	Apple Avenue 1	Replace 8" VCP with 12" due to capacity deficiency	1	640	8	12	Apple Avenue	Apple Avenue south line between 7th Street and El Camino Real	128,000	LS	200,000
1-2	Apple Avenue 2	Connect 12" line to 21" line upstream of Highway 101 crossing (Note: 12" upsized to 18" diameter, see CIP 1-6)	1	20	12	12	Apple Avenue	Apple Avenue at 5th Street Alley	25,000	LS	40,000
1-3	Vineyard Drive	Replace 10" VCP with 12" or 18" due to capacity deficiency	1	780	10	18	Vineyard Drive	Vineyard Drive from Cabernet Avenue to Vineyard Lift Station	214,500	LS	310,000
1-4	Walnut Avenue 1	Abandon 12" gravity sewer from Walnut/2nd to the WWTP	1	NA	12	---	Walnut Avenue	2nd Street to WWTP	25,000	LS	40,000
1-5	Apple Avenue 3	Replace 12" VCP with 18" due to capacity deficiency	1	250	12	18	Apple Avenue	5th St. to Junction with HWY 101 crossing	68,750	LS	100,000
1-6	Apple Avenue 4	Replace 8" and 12" VCP with 18" due to capacity deficiency	1	840	12	18	Apple Avenue	North line from 8th St. to 5th St. junction with South line	210,000	LS	300,000
1-7	Walnut Avenue 2	Replace 14" with 24" due to capacity deficiency as a result of future development (note: this CIP may be considered part of WWTP Upgrade in future)	1	220	14	24	Walnut Avenue	End of 24" line on Walnut Avenue to WWTP headworks	77,000	LS	110,000
LS-1	Tyler Lift Station	New Lift Station	1	LS	---	---	Tyler Lift Station	Tyler Lift Station	500,000	LS	700,000
LS-2	Tyler Lift Station	Backup Generator Repair/Upgrade	1	LS	-	-	Tyler Lift Station	Tyler Lift Station	5,000	LS	7,000
LS-3	Vineyard Lift Station	Wetwell Manway Repair	1	LS	-	-	Vineyard Lift Station	Vineyard Lift Station	2,500	LS	4,000
LS-4	Cypress Lift Station	Backup Power Confirmation/Assessment	1	LS	-	-	Cypress Lift Station	Tyler Lift Station	2,500	LS	4,000
								Total Existing Project Costs			#REF!

Table 7-3: Future CIPs

Project #	Title	Description	Quantity	Length (ft)	Existing Diameter (in)	New Diameter (in)	Street	Location	Construction Cost ($)		Total Project Cost ($)
F-1	Elm Avenue	Replace 8" with 10" due to capacity deficiency as a result of future development	1	1,650	8	10	Elm Avenue	Elm Avenue from Heidi Drive to Via Salvgano	288,750		410,000
F-2	Apple Avenue 6	Replace 8" with 12" due to capacity deficiency as a result of future development	1	1,500	8	12	Apple Avenue	Apple Avenue from 10th Street to 12th Street	300,000		420,000
F-3	Heidi Drive and Tyler Avenue	Replace 8" and 10" with 12" due to capacity deficiency as a result of future development	1	2,300	8	12	Heidi Drive	Heidi Drive from Elm Avenue to Tyler Avenue, Tyler to Tyler LS	460,000		650,000
F-4	2nd Street	Replace 12" with 18" due to capacity deficiency as a result of future development	1	1,300	12	18	2nd Street	2nd Street from Apple Avenue to Walnut Avenue	357,500		510,000
F-5	Apple Avenue 7	Replace 12" with 18" due to capacity deficiency as a result of future development	1	700	12	18	Apple Avenue	Apple Avenue from 2nd Street to De Ponte Drive	192,500		270,000
F-6	Wetwell Lining	Los Ositos, Reed, Nino, Vineyard	1	---	---	---	Varies	Lift Stations	15,000		21,000
								Total Future Project Costs		$	2,281,000



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LEGEND

- LIFT STATIONS
- SEWER MANHOLE
- City Boundary

DIAMETER (IN)

- 8
- 10
- 12
- 14
- 18
- 21
- 24

Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

Figure 7-1

PROPOSED MASTER PLAN SEWER SYSTEM IMPROVEMENT PROJECTS

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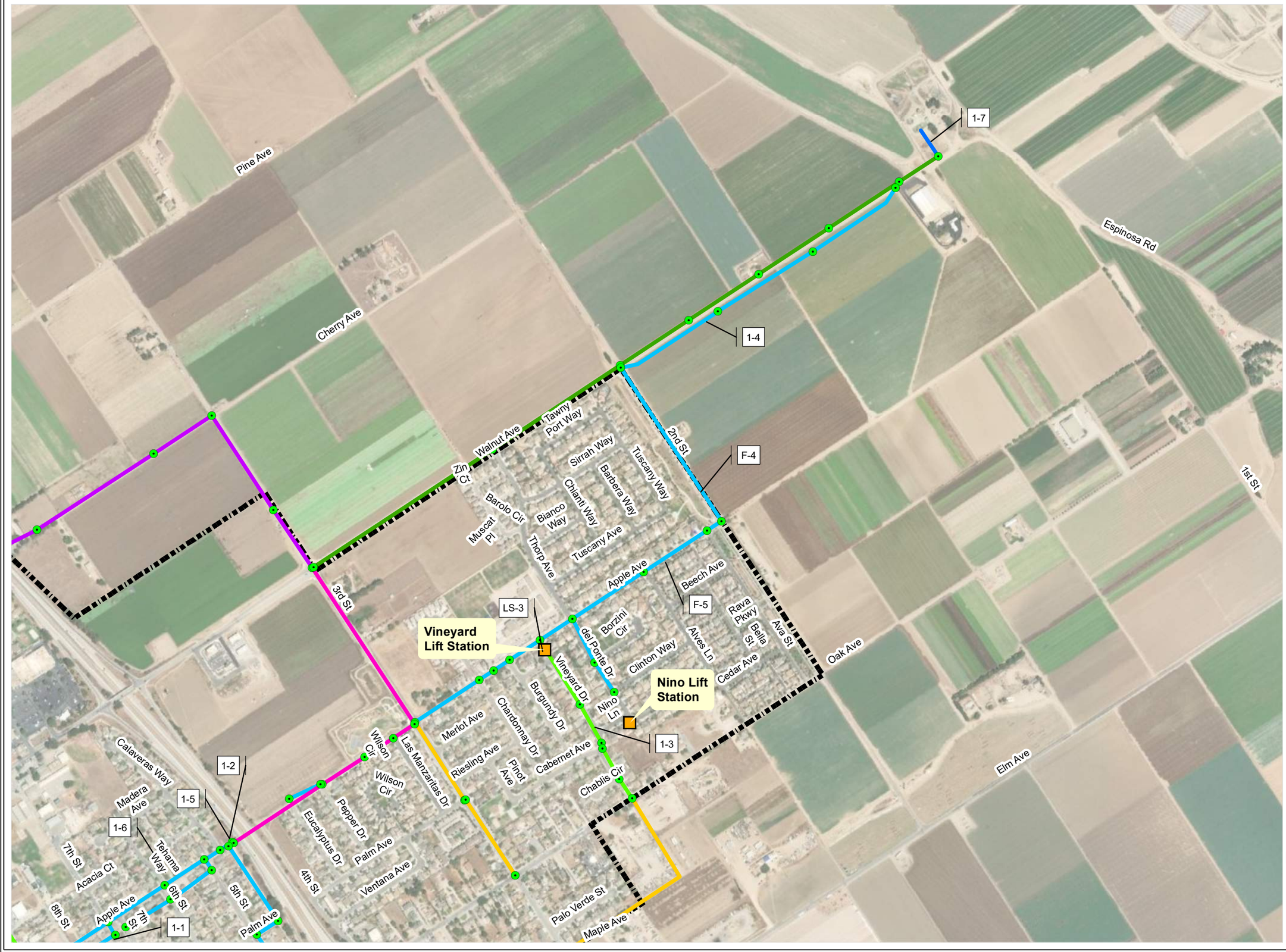

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Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

Figure 7-2
PROPOSED MASTER PLAN SEWER SYSTEM IMPROVEMENT PROJECTS

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- 24

Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

Figure 7-3
PROPOSED MASTER PLAN SEWER SYSTEM IMPROVEMENT PROJECTS

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- SEWER MANHOLE
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DIAMETER (IN)

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- 18
- 21
- 24

Note: This exhibit only shows sewer lines that were modeled as part of this master plan but does not include the entire system. Some lines have been spatially separated for reading clarity.

Figure 7-4
PROPOSED MASTER PLAN SEWER SYSTEM IMPROVEMENT PROJECTS

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APPENDIX A

APPLE AVENUE SEWER DIVERSION ANALYSIS

MEMORANDUM

City of Greenfield
Apple Avenue Sewer Diversion Analysis

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Date: April 21, 2021

To: John Alves, Public Works Director, City of Greenfield

From: Steven G. Tanaka, PE

Subject: Apple Avenue Sewer Diversion Analysis

This memorandum summarizes Wallace Group's findings relative to the City's request for further review of a sewer CIP alternative to upsizing sewer mains in Apple Avenue to remedy the existing sewer flow "bottleneck" and to accommodate future build-out flows.

This updated analysis reviewed the option to divert flows to the 24" existing sewer main at 3rd Street and Walnut Avenue) as follows:

- Install new 12" sewer main in 10th Street, between Cherry and Walnut Avenues, to direct sewage north to Cherry Avenue (that currently flows south to Apple Avenue.
- Install new 15" sewer on Cherry Avenue between 10th Street and El Camino Real (ECR), and on ECR from Cherry Avenue to existing sewer manhole in ECR north of Cherry Avenue.
- Install new sewer main from 10th Street/Walnut Avenue, westerly on Walnut Avenue to 12th Street (this requires upsizing of an existing 8" gravity sewer in Walnut Avenue near Walnut Avenue Apartments), then southerly on 12th Street to Apple Avenue. Current wastewater flows on Walnut Avenue from Franscioni Drive, plus future flows along Walnut Avenue, would be diverted away from 10th Street flowing south to Apple Avenue. At Apple Avenue and 12th Street, existing and future flows from the westerly reach of the Apple Avenue Sewer would be diverted north on 12th Street, diverting flow away from Apple Avenue sewers. This would include diversion of future flows from the Miramonte Development.

A review of existing elevations, grades and lengths of sewer, indicate that the above proposed sewer construction is feasible. Figure 1 (at the end of this memorandum) shows the new and upsized sewers required to accomplish this diversion (these sewer lines are shown in the light blue/teal color). General attributes of the new proposed 12" and 15" diameter sewers are summarized as follows:

- New sewer and manholes, at their deepest depth, will be around 16 feet.
- Average slopes/grades will be relatively flat at 0.22%

This proposed sewer diversion would effectively reduce sewer flows in the Apple Avenue sewer by approximately 50%, or 835 gpm, and eliminates the need for a number of identified Apple Avenue CIPs. Refer to Table 1 for a summary of

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estimated new sewer construction costs, and summary of Apple Avenue CIPs eliminated as a result of the potential new sewer diversion. There is a sizable cost associated with the potential newer sewer diversion, but the new sewers will also benefit future developments including MiraMonte, Walnut Avenue Apartments, and Organix Cannabis. Note that the new sewer costs bear a slightly higher unit cost due to anticipated deeper construction, and all costs include a 40% "soft cost" value for items such as administration, engineering, construction management.

New Sewers Required						
Sewer Reach	From	To	Length, ft	Diameter, inch	Total Cost, $	Comment
10th Street	Apple	Walnut	1320	12	$ 462,000	
Walnut	Francioni	10th	540	12	$ 189,000	Upsize existing 8" to 12"
Walnut	12th	Francioni	780	12	$ 273,000	
12th Street	Apple	Walnut	1320	12	$ 462,000	
10th Street	Walnut	Cherry	1320	15	$ 554,400	
Cherry	10th	ECR	675	15	$ 283,500	
ECR	Cherry	Exist. MH	300	15	$ 126,000	Exist. MH in ECR, north of Cherry
TOTAL					**$ 2,349,900**	
Apple Avenue Sewer Deficiencies Eliminated						
Sewer Reach	From	To	Length, ft	Diameter, inch	Total Cost, $	Comment
CIP 1-1 (Apple)	7th	ECR	640	12	$ 200,000	
CIP 1-2 (Apple)		Hwy 101		12	$ 40,000	
CIP 1-4 (Apple)	Larson	Larson	220	12	$ 70,000	Midblock MH east of Larson Ave
CIP 1-6 (Apple)	5th	Hwy 101	380	18	$ 150,000	
CIP 1-7 (Apple)	8th	5th	840	18	$ 300,000	
TOTAL					**$ 760,000**	

This information will be included in the Sewer Collection System Master Plan, and the decision to move forward with the new sewer diversion will need to be made by the City.

Apple Avenue Sewer Considerations

Even though capital improvement projects may be averted with the construction of a new diversion sewer, the City needs to keep in mind that the reduced flows in the Apple Avenue sewers will reduce line velocities and may increase the level of maintenance and line flushing required over the years to come.

SGT:DG

LEGEND

- LIFT STATIONS
- EXISTING MANHOLES
- NON-DEFICIENT
- REMAINS DEFICIENT
- MADE NON-DEFICIENT BY CIP
- NEW CIP MAIN LINES
- CITY BOUNDARY

Note: Deficient is defined as follows:
d/D < 0.67 for pipes less than 12"
d/D < 0.8 for pipes 12" and larger

Vineyard Lift Station

Reed Lift Station

Los Ositos Lift Station

Tyler Lift Station

Organix Existing

Organix Expansion

Walnut Grove Existing

Walnut Grove Future Phases

Walnut Trib Area 1 (Existing-2)

Walnut Trib Area 2 (North Existing-3)

Apple Trib Area 2 (South Existing-3)

Apple Trib Area 1 (Existing-1)

Miramonte

Cherry Ave
Pine Ave
Orchard St
Apricot St
McDonald Way
Barwood Way
Dart Way
de Leon Dr
de Leon Cir
Reed Way
Walnut Ave
Harvest Way
12th St
10th St
Clifton Ct
Primavera Ct
Palomar Dr
Gavilan Dr
Chalone Dr
Pinnacles Ave
Apple Ave
Hutchison Dr
Larson Ln
Pasque Ave
13th St
Morris Way
Morris Ave
Hicks Dr
Victorian Cir
Los Padres Ct
San Simeon Ct
San Antonio Dr
Tom Rogers Cir
Renfro Pl
Meadow Cir
Parkside Ct
11th St
Elmwood Dr
Don Vincente Dr
Cerrato Ct
El Camino Real
Acacia Ct
Madera Ave
Calaveras Way
Mariposa Cir
Tehama Way
8th St
7th St
9th St
Oak Ave
Palm Ave
6th St
5th St
4th St
Maple Ave
Elm Cir
Walker Ln
Ann Scott Dr
Elm Ave
Moreno St
Huerta Ave
St Charles Pl
Park Ave
St Christopher Ln
Tyler Ave
Vasquez Ave
Ventana Ave
Palm Ave
Eucalyptus Dr
Pepper Dr
Wilson Cir
Las Manzanitas Dr
Apple Ave
3rd St
Merlot Ave
Riesling Ave
Pinot Ave
Chardonnay Dr
Cabernet Ave
Burgundy Dr
Vineyard Dr
Tuscany Ave
Bianco Way
Muscat Pl
Barolo Cir
Sirrah Way
Port Ln
Zin Ct
Thorp Ave
Tawny Port Way

Greenfield
Where Historic El Camino Real Meets Monterey Wine Country

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FIGURE 1
SEWER MAINS MADE NON-DEFICIENT BY THE PROPOSED CIP IMPROVEMENT

N

1 inch = 700 feet

0 370 740

Feet