Table 4-1. Census Data

Year	Population	Increase or Decrease	Percent Change
1900	1,862	N/A	N/A
1910	2,322	460	24.7%
1920	2,635	313	13.5%
1930	2,714	79	3.0%
1940	3,108	394	14.5%
1950	4,624	1,516	48.8%
1960	5,519	895	19.4%
1970	6,024	505	9.2%
1980	7,043	1,019	16.9%
1990	7,559	516	7.3%
2000	7,481	-78	-1.0%
2010	7,864	383	5.1%
2020	7,927	63	0.8%

For the purpose of proposing an improvement program for the future, it is necessary to project the population for the design year of 2044, so that proposed equipment can be designed to accommodate future flows. Four methods of projecting the population were utilized: Arithmetic Projection, Geometric Projection, Average Percent Increase Projections Per Annual Basis, and Average Percent Increase Projections Per Decade Basis. A composite figure was calculated based on the average of the population projections described in Error! Reference source not found..

Table 4-2. Population Projections

Method	Projected Population
Arithmetic Projection for 2044	8,890
Geometric Projection for 2044	9,514
Average Annual Percent Increase Projection for 2044	10,939
Average Decade Percent Increase Projection for 2044	10,745
Average	10,022

The average of the 2044 population projections of 10,022 people will be used for the purposes of this report. The City estimates that 75% of residential growth will occur in the Dexter East WWTF basin.

4.2 Dexter East WWTF Basin

As discussed earlier in this report, the Tyson Foods plant, which accounted for approximately 48% of flows and approximately 65% of organic loading to the Dexter East WWTF, permanently

closed in October 2023. Despite the Tyson Foods plant closure, the City expects industrial growth to continue in the Dexter East area and desires that any proposed treatment options be capable of accommodating anticipated domestic and industrial growth. Since the Tyson Foods plant closure, an egg plant has set up operations and has provided the City with estimated wastewater discharges to the East WWTF.

The City anticipates that at least one industry capable of producing flows and loadings similar in nature to the existing Tyson Foods plant will open in the Dexter East area in the future and would like to be prepared to accommodate a second industrial plant in the future. **Table 4-3** describes projected 2044 flows and loadings originating from the Dexter East WWTF basin.

Table 4-3. Dexter East WWTF Basin 2044 Projected Flows and Loadings

	ADF	BOD5		TSS		Ammonia		TKN/Total N		Phosphorus	
	MGD	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day
Domestic	1.175	114	1,118	114	1,118	35	343	40	392	7	69
Egg Plant	0.050	10,000	4,173	1,500	626	2	1	600	250	7	3
Additional Industrial Capacity	0.500	425	1,774	50	209	35	146	40	167	7	29
Combined Flow	***1.725***	***491***	***7,066***	***136***	***1,954***	***34***	***490***	***56***	***809***	***7***	***101***

4.3 Dexter West WWTF Basin

The City of Dexter anticipates that only 25% of future residential growth within the City will contribute to flows and loadings to the Dexter West WWTF basin. In addition to the limited residential growth, there is no anticipated industrial growth expected to contribute to the flows and loadings at the Dexter West WWTF. **Table 4-4** describes projected 2044 flows and loadings originating from the Dexter West WWTF basin.

Table 4-4. Dexter West WWTF Basin 2044 Projected Flows and Loadings

	ADF	BOD5		TSS		Ammonia		TKN/Total N		Phosphorus	
	MGD	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day
Domestic	0.775	106	684	106	684	35	226	40	259	7	45
Combined Flow	***0.775***	***106***	***684***	***106***	***684***	***35***	***226***	***40***	***259***	***7***	***45***

5.0 RECOMMENDED ALTERNATIVE

As mentioned in **Section 1.0**, increasing flows or loadings from the Dexter East WWTF will result in significantly more stringent effluent requirements due to impairments of the current discharging stream. MDNR has indicated that any increases in flows or loadings would place limits for BOD_5 and TSS around 5 mg/L, which would require the construction of a mechanical plant with a substantial investment in tertiary filtration. In addition to the difficulties in achieving more stringent limits, the existing East WWTF is located just outside of a FEMA mapped floodplain

with no room to expand beyond its current property limits. The expected increase in restrictions to effluent limits combined with the limited space to improve the existing WWTF drive the recommendation to pump untreated wastewater received at the East WWTF to a proposed mechanical plant to be constructed at the West WWTF.

5.1 Design Criteria

Table 5-1 describes the 2044 design flows and loadings for the recommended alternative.

Table 5-1. Recommended Alternative 2044 Design Flows and Loadings

	ADF	BOD5		TSS		Ammonia		TKN/Total N		Phosphorus	
	MGD	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day	mg/L	lb/day
Dexter East Basin LS	1.725	491	7,066	136	1,954	34	490	56	809	7	101
Dexter West Basin	0.775	106	684	106	684	35	226	40	259	7	45
Combined Flow	***2.500***	***372***	***7,751***	***126***	***2,639***	***34***	***716***	***51***	***1,068***	***7***	***146***

5.2 Dexter East WWTF Component Design

A new East Basin Lift Station is proposed to be installed just downstream from the existing headworks which will remain in place. Approximately 21,225 L.F. of 12" pressure sewer will be installed to convey the design ADF of 1.725 from the East Basin Lift Station to the proposed mechanical plant at the existing Dexter West WWTF site. The existing lagoon cells will be converted to flow equalization basins to attenuate peak flow and low flow conditions. The existing outfall at the Dexter East WWTF will be retired.

5.3 Dexter West WWTF Component Design

The existing lagoon system at the Dexter West WWTF is not designed to accommodate the 2044 design flows and loadings. Installing a mechanical plant is the recommended alternative for increasing the capacity and treatment capabilities of the WWTF. The proposed mechanical plant will be designed to accommodate the combined 2044 design ADF of 2.5 MGD. The existing active lagoon cells at the Dexter West WWTF will be converted to flow equalization to attenuate peak flow and low flow conditions from the West WWTF Basin.

5.3.1 Convert Existing Lagoon Cells to Flow Equalization Basins

The three existing lagoon cells that are currently being utilized for wastewater treatment are proposed to be converted to flow equalization basins. The area where the fourth (abandoned) lagoon cell is located will be utilized for construction of a new mechanical treatment plant.

5.3.2 *Influent/EQ Lift Station*

A new influent/EQ lift station is proposed to be installed upstream of the headworks. The pump station will attenuate peak flow and low flow conditions, allowing for a more consistent flow through the remainer of the plant. The existing West Influent Lift Station will play a role in this influent flow equalization through renovation of the existing station with new pumps and discharge piping.

5.3.3 *Headworks Structure*

A new headworks building and mechanical screening system will be placed upstream of the secondary treatment process. The screening structure would include a mechanical bar screen to remove debris from the raw wastewater. A bypass channel containing a manually cleaned coarse bar screen would also be included.

5.3.4 *Extended Aeration Concentric Basins*

The secondary treatment process will be performed by two proposed concentric aeration basins that utilize common wall construction with an outer aeration ring and inner clarifier. The outer ring of each basin features four retrievable racks for retrievable design and one submersible mixer to maintain velocity in the channel. The inner clarifier basins would have a stainless-steel clarifier mechanism which can be retrieved from the basin, allowing for the mechanism to be exchanged out without taking the entire clarifier offline.

Sludge would exit the clarifier to a RAS/WAS pump station which would return a portion of the MLSS back to the headworks with the rest being routed to the sludge holding tanks. The treated effluent would exit the clarifier into a splitter box so that another concentric basin or biological process can be easily added in the future.

5.3.5 *UV Disinfection*

As mentioned in **Section 3.2**, a UV disinfection system is currently being installed at the Dexter West WWTF, however the new UV disinfection system design has considered future expansion possibilities. It is proposed to implement the new UV equipment and channel into the proposed design.

5.3.6 Sludge Handling

The portion of sludge wasted from the final clarifiers will need to be properly treated and disposed of in compliance with EPQ 503 regulations. Aerobic digester tanks and holding basins are proposed to be sized and constructed that can accommodate MDNR's requirement of 75 days of sludge storage capacity for southern Missouri. Ultimately, the treated sludge would be land applied on nearby farm fields.

5.4 Considerations for Future Expansion

Due to the uncertainty of industrial growth in and around the City of Dexter, the proposed alternative will be designed assuming that at some point in the future significant upgrades may be required to accommodate new flows. **Exhibit 1** demonstrates that there is adequate space to add additional concentric basins, sludge storage, and additional processes such as tertiary treatment if desired at a later date.

5.5 Summary of Proposed Facilities

The proposed system modifications to the existing Dexter East WWTF to meet year 2044 anticipated design conditions are shown in **Exhibit 2** and **Exhibit 3** and are summarized below.

- Convert existing lagoon cells to flow equalization basins
- Install proposed East Basin Lift Station
- Install approximately 21,225 L.F. of proposed force main from East Basin Lift Station to proposed mechanical plant at Dexter West WWTF
- Retire existing outfall at Dexter East WWTF

The proposed system modifications to the existing Dexter West WWTF to meet year 2044 anticipated design conditions are shown in **Exhibit 1** and are summarized below.

- Convert existing lagoon cells to flow equalization basins
- Install proposed influent/EQ lift station
- Install proposed headworks building and screening equipment
- Install proposed extended aeration concentric basins
- Install proposed UV system improvements
- Install proposed sludge holding basins

5.6 Cost Estimate for Recommended Alternative

Cost estimates for the recommended alternative presented in **Section 5.0** are described in

Table 5-2.

Table 5-2. Cost Estimate for Recommended Alternative

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
1	4,000	CY	Concrete	$1,200	$4,800,000
2	34,000	CY	Earthwork Cut	$15	$510,000
3	52,000	CY	Earthwork Fill	$10	$520,000
4	1	LS	Misc. Site Work/Earthwork	$103,000	$103,000
5	1,200	LF	24" Gravity Sewer	$300	$360,000
6	1,250	LF	12" Pressure Sewer	$200	$250,000
7	1,100	LF	6" Sludge Line	$60	$66,000
8	1	LS	Misc. Piping	$350,000	$350,000
9	2	EA	12" Parshall Flume	$50,000	$100,000
10	1	LS	Influent Lift Station Pumps & Equipment	$800,000	$800,000
11	1	LS	Mechanical Bar Screen	$430,000	$430,000
12	1	LS	Headworks Building	$500,000	$500,000
13	1	LS	Concentric Basin Equipment	$3,200,000	$3,200,000
14	1	LS	UV Equipment and Building	$750,000	$750,000
15	1	LS	Aerobic Digester Equipment for four 85' Basins	$650,000	$650,000
16	1	LS	Return/Waste Sludge (RAS/WAS) Pumps	$100,000	$100,000
17	1	LS	Retrofit Existing Lagoons to Flow Equalization	$250,000	$250,000
18	1	LS	Coatings	$300,000	$300,000
19	1	LS	Misc. Metals	$400,000	$400,000
20	1	LS	Electrical	$2,166,000	$2,166,000
21	1	LS	Backup Generator for Critical Loads	$250,000	$250,000
22	1	LS	Lift Station & Pressure Line to Pump East to West	$4,820,000	$4,820,000
23	1	LS	Mobilization, Bonding, Insurance, Etc.	$867,000	$867,000
			Construction Sub-Total		$22,542,000
			20% Contingency		$4,509,000
			Environmental Assessment		$40,000
			Geotechnical Engineering		$50,000
			Power to Site		$75,000
			Design Engineering		$1,487,772
			Construction Engineering		$595,109
			Easement Acquisition		$225,000
			Resident Project Representative		$460,000
			Total Estimated Construction Cost		**$29,983,881**

5.7 Phased Approach to Construction of New Treatment Facilities

The West Lagoon Lift Station will need to be modified to accommodate the current and future flows as well as the point to which it pumps when the new plant is constructed. Currently, this lift station is overloaded and needs to be expanded before the new treatment plant is constructed to prevent system back-ups during peak flows. Due to the immediate need to make improvements

at the West Lagoon Lift Station it is recommended that the project be broken into two phases. The first phase would be improvements to the West Lagoon Lift Station to accommodate higher flows in a manner that can be expanded upon and utilized when the new plant is constructed. The second phase would be the construction of the new plant and improvements associated with pumping the flow from the East Lagoon to the new treatment facility. Phase 1 is significantly smaller, but the timely implementation of these improvements at the West Lagoon Lift Station is critical to prevent immediate issues with the collection system. Following is a break down of the cost associate with the two phases.

Table 5-3. Cost Estimate for Phase 1 - Recommended Alternative

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT TOTAL	TOTAL
1	1	LS	Lift Station Bypass Pumping	$25,000	$25,000
2	3	EA	Pumps	$22,500	$67,500
4	1	LS	Discharge Piping in Wet Well and Vavle Pit	$20,000	$20,000
5	1	LS	Yard Piping	$55,000	$55,000
6	1	LS	Pump Panel/ Electrical	$85,000	$85,000
7	1	LS	Misc Grading, Piping, Etc.	$20,000	$20,000
8	1	LS	Mobilization, Bonding, Insurance, Etc.	$12,000	$12,000
			Construction Sub-Total		$284,500
			20% Contingency		$56,900
			Design Engineering		$32,000
			Construction Engineering		$12,800
			Resident Project Representative*		$12,500
			Total Estimated Construction Cost		**$398,700**

* includes 2 site visits for progress and final inspection with engineer

Table 5-4. Cost Estimate for Phase 2 - Recommended Alternative

ITEM	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE	TOTAL
1	4,000	CY	Concrete	$1,200	$4,800,000
2	34,000	CY	Earthwork Cut	$15	$510,000
3	52,000	CY	Earthwork Fill	$10	$520,000
4	1	LS	Misc. Site Work/Earthwork	$103,000	$103,000
5	1,200	LF	24" Gravity Sewer	$300	$360,000
6	1,250	LF	12" Pressure Sewer	$200	$250,000
7	1,100	LF	6" Sludge Line	$60	$66,000
8	1	LS	Misc. Piping	$350,000	$350,000
9	2	EA	12" Parshall Flume	$50,000	$100,000
10	1	LS	Influent Lift Station Pumps & Equipment	$515,500	$516,000
11	1	LS	Mechanical Bar Screen	$430,000	$430,000
12	1	LS	Headworks Building	$500,000	$500,000
13	1	LS	Concentric Basin Equipment	$3,200,000	$3,200,000
14	1	LS	UV Equipment and Building	$750,000	$750,000
15	1	LS	Aerobic Digester Equipmet for four 85' Basins	$650,000	$650,000
16	1	LS	Return/Waste Sludge (RAS/WAS) Pumps	$100,000	$100,000
17	1	LS	Retrofit Existing Lagoons to Flow Equalization	$250,000	$250,000
18	1	LS	Coatings	$300,000	$300,000
19	1	LS	Misc. Metals	$400,000	$400,000
20	1	LS	Electrical	$2,166,000	$2,166,000
21	1	LS	Backup Generator for Critical Loads	$250,000	$250,000
22	1	LS	Lift Station & Pressure Line to Pump East to West	$4,820,000	$4,820,000
23	1	LS	Mobilization, Bonding, Insurance, Etc.	$867,000	$867,000
			Construction Sub-Total		$22,258,000
			20% Contingency		$4,452,000
			Environmental Assessment		$40,000
			Geotechnical Engineering		$50,000
			Power to Site		$75,000
			Design Engineering		$1,455,772
			Construction Engineering		$582,309
			Easement Acquisition		$225,000
			Resident Project Representative		$447,500
			Total Estimated Construction Cost		**$29,585,581**