The WWTP capacity must also be increased to meet the projected needs for the year 2023. Finally, recommendations are presented on how the community should proceed with design and construction of necessary improvements.

OVERVIEW OF EXISTING WWTP

Headworks

The existing headworks of the WWTP consist of mechanical solids removal equipment, a manual bar screen, and an aerated grit chamber. The mechanical solids removal equipment is a Hycor Helisieve Model HLS400P. The unit was purchased and installed by the City in 1996 and replaced the original comminutor unit. The unit is sized to handle peak flows of up to 2.5 MGD, therefore it does not need to be replaced as part of the treatment plant modifications. Since this is not a critical component of the treatment process, redundancy is not required. However, a second unit will be required when the peak flow to the WWTP reaches 2.5 MGD, therefore the second unit should be installed as part of the recommended Phase II WWTP upgrade.

Inorganic grit is separated from organic settleable solids in the aerated grit collection chamber at the end of the existing headworks structure. The chamber is approximately 8.5 feet wide x 11 feet long x 10 feet deep. Aeration within the chamber causes a rolling action that allows grit and heavy solids to settle in a hopper near the inlet to the chamber. The grit that settles into the hopper beneath the air diffusers is removed by an open impeller pump and pumped through a cyclonic separator and then into a grit classifier. The cyclonic separator operates on the principle of centrifugal force with grit being removed by a circular motion that occurs inside the tapered cones. The classifier consists of a rectangular box with a long shallow inclined ramp and settling chamber at the low (or feed) end. Reciprocating rakes scrape grit up the incline and allow water to flow back down the ramp and continue on to the primary clarifier. Grit is manually removed and hauled from the classifier. The unit is currently working, however, the operator reports that it requires frequent cleaning and hauling due to the amount of grit removed. An improved grit removal system is recommended as discussed under the review of alternatives later in this section.

Primary Clarifier

The existing WWTP has a single primary clarifier basin. The basin is 28 feet in diameter and has a maximum sidewater depth of 8.6 feet. The surface loading rate for the primary clarifier at the average wet weather design flowrate of 0.48 million gallons per day (MGD) is 780 gallons per day per square foot, (gpd/ft^2) and the detention time is 2 hours. The surface loading rate at the peak design flowrate of 1.2 MGD is 1,950 gpd/ft^2. Both these values are slightly below the low end of generally accepted range of loading rates. Weir overflow rates at 0.48 MGD and 1.2 MGD are about 5,900 gallons per day per linear foot (gpd/lf) and 14,700 gpd/lf, respectively. These are well below generally accepted loading rates for shallow primary clarifiers (8-9 feet side water depth) of 10,000 gpd/lf for average flow and 20,000 gpd/lf for peak flow.

Sludge from the SBC/RBC units which settles in the secondary clarifier is pumped back to the primary clarifier and is mixed with the primary sludge. Therefore, the entire accumulation of sludge from the wastewater treatment process is collected in the primary clarifier and is pumped to the aerobic digester by a 75 gpm Moyno progressing cavity pump located in the blower building.

The existing clarifier operates well and does not have serious problems associated with the tankage or the radial rake collection mechanism. Total and soluble BOD_5 data taken in June and July of 1998 indicates that the primary clarifier is removing an average of 52% of influent total BOD_5 from the wastewater (range was 34-60% removal). This is significantly higher than typical design criteria of 30-35% for total BOD_5 removal. The high level of removal can likely be attributed to a combination of two things: 1) the relatively low surface loading rate at flows of 0.48 MGD or less; and 2) more than a third of the total influent BOD_5 is settleable. The high removal rate across the primary clarifier provides lower loading rates of total BOD_5 and TSS to downstream processes than standard design criteria would indicate. This provides the WWTP with additional process flexibility and treatment capacity. No significant work is required on this unit as part of a WWTP capacity expansion project. The type of work that is recommended to be performed on this unit, if the expanded WWTP continues to utilize primary clarifiers, is cleaning and re-coating the tank (both the interior and exterior), and the clarifier mechanism.

Biological Contactor Units

The two existing RBC units were installed in 1974 when the WWTP was constructed. The plant was originally sized for an average wet weather flow of 0.48 MGD based on a hydraulic loading rate of 3.7 gallons per day per square foot of media surface area (gal/day-ft^2). The maximum acceptable hydraulic loading rate when Woodland's plant was designed was 4.0 gal/day-ft^2. In 1978, DOE published the first edition of their *"Criteria for Sewage Works Design."* This design manual changed the state's design criteria for RBC units from a hydraulic loading rate to an organic loading rate based on both total and soluble BOD_5. The organic loading rates for biological contactors implemented by DOE in 1978 are still applicable for unaerated RBC units. Organic loading criteria was implemented in the late 1970's due to poor performance of systems originally sized based strictly on hydraulic loading rates. Specific loading rates for aerated SBC and RBC treatment units are not included in the updated DOE *"Criteria for Sewage Works Design"* issued in January 1999.

Since the early 1980's extensive field testing of existing WWTP's around the country and pilot testing of units with wastewater of varying loadings has shown soluble BOD_5 is the controlling parameter for biological contactor process design.

In the early 1980's supplemental aeration of mechanically driven RBC units was incorporated into the process as a means to reduce biomass thickness and weight for organically overloaded units. It was then determined by pilot plant studies and full scale plant operation that supplemental aeration provides increased process performance, is the most effective means to reduce or eliminate nuisance growths experienced on contactor media, and increases overall oxygen transfer capability. For these reasons, first stage organic loading for aerated units can be higher than for unaerated units. Various ranges of total and soluble BOD_5 loading rates for first stage and total system media surface areas are found in nationally recognized wastewater design texts, information published by the U.S. Environmental Protection Agency (EPA), and in literature published by various equipment manufacturers. Table VII-1 summarizes the range of currently applicable design criteria for aerated biological contactor systems. The success of incorporating supplemental aeration to mechanically driven units led to the development of air-driven RBC units and ultimately to air-driven SBC units.

Table VII – 1
Range of Accepted Loading Rates for Aerated SBC/RBC Process Units

Reference	Unit	Total BOD_5 Loading (lbs/day-1,000 ft^2)	Soluble BOD_5 Loading (lbs/day-1,000 ft^2)
Water & Wastewater Technology – 3rd Edition – Hammer & Hammer, 1996	First Stage	12	6
	Total System	3	1.5
Seminar on RBC's – Klargester, Inc. – 1994	First Stage		3-4
Wastewater Engineering – Treatment, Disposal, Reuse – 3rd Edition – Metcalf & Eddy, 1991	First Stage	8-12	4-6
	Total System	2-3.5	0.75-2
Aerated SBC Process Design Procedure– Envirex – 1991	First Stage		4-5
Aerated RBC Process Design Procedure – Walker Process – 1991	First Stage		4
Water Supply & Pollution Control – 4th Edition Viesmann & Hammer, 1985	First Stage	12	6
	Total System	3	1.5
Summary of Design Information on Rotating Biological Contactors – EPA – 1984	First Stage	6-8	2.5-4
Loading Rates Utilized in this Report	**First Stage**	**5.8**	**3.5**
	Total System	**2.5**	**1.5**

1: First stage and total system BOD_5 loading rates are based on a soluble BOD_5:total BOD_5 ratio of 0.6.

Data from numerous plants have been utilized in developing the loading ranges in Table VII-1. The increased efficiency of the aerated biological contactor process over the unaerated process has repeatedly been demonstrated in numerous studies and in on-going WWTP performance (including Woodland's WWTP) over the past 15 years.

The temperature of the wastewater being treated affects the performance of the biological contactor process as it does with any biological treatment process. When the wastewater temperature is 55 degrees F, (13 deg. C), or higher there is no adverse affect on treatment performance. Below 55 deg. F, biological contactor treatment efficiency is diminished due to the slow down in biological and metabolic activity. The temperature of the influent wastewater at Woodland's WWTP from July 1, 1996 to June 30, 1998, has ranged from 57–75 deg. F. No adjustment for wastewater temperature below 55 deg. F is required when reviewing the capacity of Woodland's existing SBC and RBC units. It is likely that biological reaction rates actually continue to improve as temperature increases above 55 deg. F as they do with activated sludge processes, however, no design procedure utilized by RBC/SBC equipment manufacturers utilizes temperatures above 55 deg. F.

Each of Woodland's two existing RBC units has three stages. The first stage of each unit has 32,500 ft^2 of media surface area. The second and third stage of each unit has a total of 32,500 ft^2 of media surface area, (16,250 ft^2 per stage). Therefore, total first stage RBC surface area is 65,000 ft^2 and the total overall RBC surface area is 130,000 ft^2. In the City of Woodland's 1981 NPDES permit, the average wet weather design flow (AWWF) for the plant was changed from 0.48 MGD to 0.26 MGD based on DOE's revised RBC design criteria. The revised flowrate was apparently based on the average of the resultant flows of the first stage total BOD_5 loading and total system total BOD_5 loading as shown in Table VII-2.

Table VII-2
1981 Revised Average Design Flow for Woodland WWTP
Based on 1978 DOE Loading Rates for RBC's

Unit	*Maximum RBC Loading (lbs/day)*	*Average Flow (MGD)*
First Stage Total BOD_5	325.0	0.292[1]
Total System Total BOD_5	260.0	0.234[1]
First Stage Soluble BOD_5	162.5	0.244[2]
Total System Soluble BOD_5	143.0	0.214[2]

1: Flow calculated based on 33% removal of total BOD_5 across primary clarifier and influent BOD_5 concentration of 200 mg/l.
2: Flow calculated based on soluble BOD_5 being 60% of total BOD_5 per Table VII-1, 33% removal of total BOD_5 across primary clarifier and influent BOD_5 concentration of 200 mg/l.

Woodland's RBC units are mechanically driven units, with between 40-45 percent of the total media submerged in the wastewater at all times. As initially designed and installed, oxygen was transferred to the biomass only through exposure to the atmosphere of the RBC media as the shaft rotated. As previously stated, supplemental aeration of mechanically driven units was developed in the early 1980's. At some point in the 1980's the City of Woodland modified the RBC units by incorporating supplemental aeration to all stages of both units.

The successful incorporation of supplemental aeration to mechanically driven units led to the development of air driven RBC units in the mid-1980's. In the late 1980's a new generation of biological contactors was developed called Submerged Biological Contactors (SBC). This process was a significant breakthrough in biological contactor technology. By utilizing only air to drive the units, and submerging the media so that 70-90% of the media is submerged in wastewater at all times, the amount of media surface area provided could be greatly increased. This is due to the fact that by utilizing the buoyant affect of the water passing through the contactor basin, structural loading of the horizontal shaft is significantly reduced. This allowed for media with significantly larger diameters to be developed. Typical RBC's have media that are 12-feet in diameter (minimum surface area per layer of corrugated media is 510 ft^2). Typical SBC's have media that are 16 to 18-feet in diameter (minimum surface area per layer of corrugated media is 810 ft^2).

In 1993, the City of Woodland constructed an SBC adjacent to the existing RBC units. The SBC was constructed to re-establish the plant's design flow to 0.48 MGD. The SBC installed is a three stage unit. The first stage has a total media surface area of 148,500 ft^2. The second and third stages each have a total media surface area of 68,600 ft^2, for a total media surface area of 285,700 ft^2. Influent piping to the SBC and RBC units was constructed so that the units can be operated either in series or in parallel. The units have been operated in series since the SBC went on line in late 1993. When operated in series, the total first stage media surface area is the 148,500 ft^2 of the SBC, and the total system surface area is 415,700 ft^2 which includes both the SBC and the two RBC units. If the units are operated in parallel, the total first stage media surface area is 213,500 ft^2, and again the total system surface area is 415,700 ft^2. Table VII-3 summarizes the modified Woodland WWTP design capacity, based on a first stage soluble BOD_5 loading rate of 3.5 lbs/day-1,000ft^2 and a total system soluble BOD_5 loading rate of 1.5 lbs/day-1,000ft^2 for the SBC/RBC units for both series and parallel operation. Design criteria utilized in sizing the SBC upgrade in 1993 and design criteria utilized when the WWTP was initially constructed is summarized in Table VII-4.

Table VII-3
Maximum BOD5 Loading for Woodland WWTP SBC/RBC Units

	SBC & RBC Units Operating in Series		*SBC & RBC Units Operating in Parallel*	
SBC/RBC	**Media Surface Area (1,000 ft^2)**	**Maximum BOD5 Loading (lbs/day)**	**Media Surface Area (1,000 ft^2)**	**Maximum BOD5 Loading (lbs/day)**
First Stage Soluble BOD_5	148.5	519.8	213.5	747.3
Total System Soluble BOD_5	415.7	623.5	415.7	623.5
First Stage Total BOD_5	148.5	866.3	213.5	1,245.4
Total System Total BOD_5	415.7	1,039.2	415.7	1,039.2

Table VII-4
Original and Revised Estimates of WWTP Loading

	1992 General Sewer Plan Predicted Year 2010 Loading	*1974 WWTP Design Criteria*
Population	4,380 people	3,500 people
Flow		
ADWF[1]	0.411 MGD	0.480 MGD
AWWF[2]	0.480 MGD	0.480 MGD
PDF[3]	0.716 MGD	1.200 MGD
PHF[4]	1.200 MGD	1.200 MGD
Total Influent BOD_5	675 lbs/day 197 mg/l	800 lbs/day 200 mg/l
Total Influent SS	784 lbs/day 229 mg/l	880 lbs/day 220 mg/l

1: ADWF = Average Dry Weather Flow
2: AWWF = Average Wet Weather Flow
3: PDF = Peak Day Flow
4: PHF = Peak Hour Flow

The 1992 GSP indicated that the two existing RBC units were undersized based on the then accepted DOE design criteria for unaerated units. The report also indicated that to treat the waste load from the year 2010 projected population of 4,380 people, the RBC units needed to be expanded to provide a total media surface area of at least 300,000 ft^2. The first stage media surface area required to comply with the 1978 DOE design criteria was 132,000 ft^2. The report further recommended that the City seriously consider installing an 18-foot diameter by 25 foot long SBC unit to upgrade the capacity of the WWTP. As previously mentioned the total media surface area of this SBC is 285,700 ft^2, which is only 14,300 ft^2 less than the 300,000 ft^2 required for the projected 2010 wasteload. In addition, the first stage contains 16,500 ft^2 more surface area than was required to comply with the 1978 DOE design criteria for the projected 2010 load. As indicated in the 1992 GSP, the SBC unit that was installed in 1993 complies with the DOE loading rate criteria for unaerated units at the 1992 GSP projected 2010 wasteload shown in Table VII-4 without considering the surface area of the existing RBC units.

To determine the actual flow and wasteload that the existing WWTP can handle based on existing flows and loading, samples were tested to determine the soluble and total BOD_5 in both the WWTP influent, and in the influent to the SBC/RBC units (primary clarifier effluent). The samples were also taken to determine the actual amount of soluble BOD_5 that is present in the City's wastewater since soluble BOD_5 is the controlling parameter for SBC and RBC process design. In addition, the samples provided field data for determining the total BOD_5 removal that is actually occurring across the primary clarifier.

Tables VII-5 and VII-6 summarize the total and soluble BOD_5 sample data compiled by the City of Woodland's WWTP operator during June and July of 1998. Total and soluble BOD_5 concentrations were determined for the primary clarifier influent (Table VII-5) and effluent (Table VII-6). As the plant is currently operated all of the effluent from the primary clarifier passes through the SBC unit and then is split between the two RBC units. This analysis assumes that no soluble BOD_5 is removed across the primary clarifier.

Table VII-5 Woodland Dry Weather Actual Raw Wastewater Total and Soluble BOD_5 Loading						
Date	*Influent Flow (MGD)*	*Total Influent BOD_5 (mg/l)*	*Total Influent BOD_5 (lbs)*	*Soluble Influent BOD_5 (mg/l)*	*Soluble Influent BOD_5 (lbs)*	*Ratio Of Soluble To Total BOD_5*
24-Jun-98	0.337	297	835	107	301	36%
25-Jun-98	0.371	344	1,065	114	353	33%
1-Jul-98	0.340	353	1,001	106	301	30%
2-Jul-98	0.308	374	961	142	365	38%
9-Jul-98	0.338	374	1,054	130	367	35%
10-Jul-98	0.346	495	1,429	150	433	30%
15-Jul-98	0.357	275	819	92	274	33%
AVERAGE	0.342	359	1,023	120	342	34%
90th Percentile	0.363	422	1,210	145	393	37%
95th Percentile	0.367	459	1,319	148	413	37%
99th Percentile	0.370	488	1,407	150	429	38%

Table VII-6 Dry Weather Actual Primary Clarifier Effluent Total BOD_5 Loading				
Date	*Flow (MGD)*	*Primary Clarifier Effluent Total BOD_5 (mg/l)*	*Primary Clarifier Effluent Total BOD_5 (lbs)*	*% Total BOD_5 Removal By Primary Clarifier*
24-Jun-98	0.337	195	548	34%
25-Jun-98	0.371	167	517	51%
1-Jul-98	0.340	140	397	60%
2-Jul-98	0.308	179	460	52%
9-Jul-98	0.338	148	417	60%
10-Jul-98	0.346	237	684	52%
15-Jul-98	0.357	136	405	51%
AVERAGE	0.342	172	490	52%
90th Percentile	0.363	212	602	60%
95th Percentile	0.367	224	643	60%
99th Percentile	0.370	234	676	60%

This data indicates that the primary clarifier is removing from 34-60% of the total BOD_5. Table VII-7 shows the range of actual total and soluble BOD_5 loading in pounds per day (lbs/day) to the existing SBC and RBC units utilizing the minimum, maximum and average values from Table VII-6. First stage loading is based on a media surface area of 148,500 ft^2. Total system loading is based on a total media surface area of 415,700 ft^2.

Table VII-7 Range of Actual Dry Weather Total and Soluble BOD$_5$ Loading to SBC/RBC Units					
Total BOD$_5$ Loading (Lbs)	**Soluble BOD$_5$ Loading (Lbs)**	**First Stage Total BOD$_5$ Loading (lbs/day-1000ft^2)**	**First Stage Soluble BOD$_5$ Loading (lbs/day-1000ft^2)**	**Total System Total BOD$_5$ Loading (lbs/day-1000ft^2)**	**Total System Soluble BOD$_5$ Loading (lbs/day-1000ft^2)**
Minimum Loading Values					
397	274	2.67	1.66	0.96	0.66
Average Loading Values					
490	342	3.30	2.30	1.18	0.82
Maximum Loading Values					
684	433	4.61	2.91	1.65	1.04
Aerated SBC/RBC Design Loadings from Table VII-3					
		5.8	3.5	2.5	1.5

As seen in Table VII-7, Woodland's existing SBC/RBC units are currently loaded at less than nationally accepted aerated unit loading rates during dry weather flows. An analysis of predicted loading at the AWWF of 0.48 MGD was performed to determine if the existing units have enough capacity to comply with these same standards during wet weather conditions. Tables VII-8 and VII-9 summarize the predicted wet weather total and soluble BOD$_5$ loads. Predicted total and soluble BOD$_5$ concentrations were calculated for the primary clarifier influent (Table VII-8) and effluent (Table VII-9). During wet weather all the effluent from the primary clarifier passes through the SBC unit and then is split between the two RBC units. This analysis assumed no soluble BOD$_5$ is removed across the primary clarifier.

Table VII-8
Woodland Wet Weather Predicted Raw Wastewater Total and Soluble BOD_5 Loading

Date	*Flow (MGD)*	*Total BOD_5 (mg/l)*	*Total BOD_5 (lbs)*	*Soluble BOD_5 (mg/l)*	*Soluble BOD_5 (lbs)*	*Ratio Of Soluble To Total BOD_5*
11/8/96	0.340	258	732	98	278	38%[1]
11/15/96	0.149	175	217	67	82	38%[1]
11/20/96	0.364	282	856	107	325	38%[1]
11/26/96	0.372	300	931	114	354	38%[1]
12/4/96	0.472	405	1,594	154	606	38%[1]
12/11/96	0.461	333	1,280	127	486	38%[1]
12/17/96	0.539	250	1,124	95	427	38%[1]
12/26/96	0.621	202	1,046	77	397	38%[1]
1/1/97	0.973	169	1,372	64	521	38%[1]
1/9/97	0.843	266	1,870	101	711	38%[1]
1/15/97	0.682	229	1,303	87	495	38%[1]
1/23/97	0.582	215	1,044	82	397	38%[1]
1/29/97	0.489	239	975	91	371	38%[1]
2/5/97	0.562	272	1,275	103	485	38%[1]
2/11/97	0.493	220	905	84	344	38%[1]
2/19/97	0.457	269	1,025	102	390	38%[1]
2/26/97	0.438	300	1,096	114	416	38%[1]
11/4/97	0.314	345	904	131	344	38%[1]
11/12/97	0.210	245	429	93	163	38%[1]
11/18/97	0.290	347	839	132	319	38%[1]
11/26/97	0.308	308	791	117	301	38%[1]
12/2/97	0.286	358	854	136	325	38%[1]
12/9/97	0.328	302	826	115	314	38%[1]
12/16/97	0.347	272	787	103	299	38%[1]
12/23/97	0.311	298	773	113	294	38%[1]
12/30/97	0.288	315	757	120	288	38%[1]
1/6/98	0.341	270	768	103	292	38%[1]
1/13/98	0.510	209	889	79	338	38%[1]
1/20/98	0.439	329	1,205	125	458	38%[1]
1/28/98	0.443	208	769	79	292	38%[1]
2/3/98	0.384	210	673	80	256	38%[1]
2/10/98	0.322	172	462	65	176	38%[1]
2/17/98	0.337	235	661	89	251	38%[1]
2/24/98	0.344	214	614	81	233	38%[1]
90th Percentile		341	1,296	130	492	

1: The 99th percentile dry weather ratio of soluble to total BOD_5 is utilized in this analysis as the predicted wet weather ratio of soluble to total BOD_5.

Table VII-9 Woodland Wet Weather Predicted Primary Clarifier Effluent Total BOD$_5$ Loading				
Date	*Flow (MGD)*	*Primary Clarifier Effluent Total BOD$_5$ (mg/l)*	*Primary Clarifier Effluent Total BOD$_5$ (lbs)*	*% Total BOD$_5$ Removal By Primary Clarifier*
11/8/96	0.340	173	488	33%[1]
11/15/96	0.149	117	145	33%[1]
11/20/96	0.364	189	571	33%[1]
11/26/96	0.372	201	621	33%[1]
12/4/96	0.472	271	1,063	33%[1]
12/11/96	0.461	223	853	33%[1]
12/17/96	0.539	168	749	33%[1]
12/26/96	0.621	135	701	33%[1]
1/1/97	0.973	113	919	33%[1]
1/9/97	0.843	178	1,253	33%[1]
1/15/97	0.682	153	873	33%[1]
1/23/97	0.582	144	699	33%[1]
1/29/97	0.489	160	650	33%[1]
2/5/97	0.562	182	854	33%[1]
2/11/97	0.493	147	606	33%[1]
2/19/97	0.457	180	687	33%[1]
2/26/97	0.438	201	734	33%[1]
11/4/97	0.314	231	606	33%[1]
11/12/97	0.210	164	287	33%[1]
11/18/97	0.290	232	562	33%[1]
11/26/97	0.308	206	530	33%[1]
12/2/97	0.286	239	572	33%[1]
12/9/97	0.328	201	553	33%[1]
12/16/97	0.347	182	527	33%[1]
12/23/97	0.311	200	518	33%[1]
12/30/97	0.288	211	507	33%[1]
1/6/98	0.341	181	515	33%[1]
1/13/98	0.510	140	596	33%[1]
1/20/98	0.439	220	807	33%[1]
1/28/98	0.443	139	515	33%[1]
2/3/98	0.384	141	451	33%[1]
2/10/98	0.322	115	310	33%[1]
2/17/98	0.337	157	443	33%[1]
2/24/98	0.344	143	411	33%[1]
90th Percentile		229	867	

1: Standard design value of 33% Total BOD$_5$ removal by Primary Clarifier is utilized in this analysis to estimate the concentrations of Total BOD$_5$ in the clarifier effluent during wet weather.

To be conservative a total BOD_5 removal rate across the primary clarifier of 33% was utilized in Table VII-9. It is expected that the actual total BOD_5 removal rate across the primary clarifier at the AWWF will be between the 33% used in the analysis and the 52% which occurred in June and July of 1998. Table VII-10 shows the estimated soluble BOD_5 and total BOD_5 loading to the existing SBC and RBC units utilizing the 90th percentile BOD_5 loading values from Tables VII-8 and VII-9. First stage loading is based on a first stage media surface area of 148,500 ft^2. Total system loading is based on a total media surface area of 415,700 ft^2.

Table VII-10
Range of Estimated Wet Weather
Total and Soluble BOD_5 Loading to SBC/RBC Units Operated in Series

Total BOD_5 Loading (Lbs)	Soluble BOD_5 Loading (Lbs)	First Stage Total BOD_5 Loading (lbs/day-1000ft²)	First Stage Soluble BOD_5 Loading (lbs/day-1000ft²)	Total System Total BOD_5 Loading (lbs/day-1000ft²)	Total System Soluble BOD_5 Loading (lbs/day-1000ft²)
90th Percentile Loading Values from 1996-97 & 1997-98 Wet Weather Periods					
867	492	5.84	3.31	2.09	1.18
Aerated SBC/RBC Design Loadings from Table VII-1					
		5.8	3.5	2.5	1.5

In terms of the loading rates recommended by the sources listed in Table VII-1 for aerated biological contactors, Woodland's existing units will be at or below the first stage and total system loading rates for total BOD_5 and soluble BOD_5 even at an AWWF of 0.48 MGD.

Table VII-11 shows the estimated soluble BOD_5 and total BOD_5 loading in lbs/day to the existing SBC and RBC units utilizing the 90th percentile BOD_5 loading values from Tables VII-8 and VII-9 if the units are operated in parallel. First stage loading is based on a first stage media surface area of 213,500 ft^2. Total system loading is based on a total media surface area of 415,700 ft^2.

Table VII-11 Range of Estimated Wet Weather Total and Soluble BOD_5 Loading to SBC/RBC Units if Operated in Parallel					
Total BOD_5 Loading (Lbs)	Soluble BOD_5 Loading (Lbs)	First Stage Total BOD_5 Loading (lbs/day-1000ft^2)	First Stage Soluble BOD_5 Loading (lbs/day-1000ft^2)	Total System Total BOD_5 Loading (lbs/day-1000ft^2)	Total System Soluble BOD_5 Loading (lbs/day-1000ft^2)
90th Percentile Loading Values for 1996-97 & 1997-98 Wet Weather Periods					
867	492	4.06	2.30	2.09	1.18
Aerated SBC/RBC Design Loadings from Table VII-1					
		5.8	3.5	2.5	1.5

Based on the loadings in Table VII-10 there is no reason to operate the units in parallel at 0.48 MGD and the 90th percentile wet weather BOD_5 load concentrations. If, however, the City chose to operate the SBC/RBC units in parallel first stage loadings would be significantly below acceptable aerated unit loading rates. Peak hour loading rates were not considered in this analysis since there are no widely accepted design loading rates for peak hour loads. In addition, designed biological contactors can withstand hydraulic and organic surges better than most suspended solid processes as referenced in Metcalf & Eddy and verified by operators at numerous successful RBC and SBC wastewater treatment plants.

As mentioned previously, extensive field testing of existing WWTP's across the country and pilot testing of units with wastewaters of varying loading has shown that total BOD_5 is not the controlling factor in optimizing the treatment performance of the biological contactor process. Both the above analysis and the high level of treatment consistently provided by the Woodland WWTP in terms of BOD_5 removal demonstrate that soluble BOD_5 loading is the controlling process parameter for the Woodland WWTP.

Conclusions from the SBC/RBC capacity analysis are that the existing SBC/RBC units are not overloaded but are nearing their loading capacity, therefore the community needs to complete planning and design work to increase secondary treatment capacity.