CITY OF BLANCO WASTEWATER SYSTEM

REVIEW OF CONVENTIONAL CENTRALIZED SYSTEM COLLECTION SYSTEM COSTS IN AREA SOUTH OF THE BLANCO RIVER AND ANALYSIS OF COSTS TO PROVIDE SERVICE WITH A DECENTRALIZED CONCEPT STRATEGY

Prepared for Protect Our Blanco
by David Venhuizen, P.E.

INTRODUCTION

A report, dated January 2, 2020, titled "City of Blanco, Preliminary Investigations and Report, Wastewater Collection System Improvements for Proposed Service Area" was submitted by Smith Turrieta Engineering. Protect Our Blanco (POB) requested a review of that report and an analysis of the facilities that would be needed to provide wastewater service to the area in question by pursuing instead a "decentralized concept" strategy, and for cost estimates to implement those facilities, instead of extending the conventional collection system throughout this area. This report provides that review and analysis.

The Smith Turrieta report addresses the area south of the Blanco River that is defined by the City of Blanco as the service area of its wastewater management system. This includes areas within the current Blanco city limits, within its current extraterritorial jurisdiction (ETJ), and areas outside of the ETJ. The report states that the current city limits encompasses about 1,400 acres, some of which is "currently undeveloped or under developed", and that the additional area with its defined wastewater system service area is 8,500 acres. The portion of these areas south of the river were divided into 14 areas, covering approximately 3,930 acres.

The Smith Turrieta report sets forth the collection mains and lift stations asserted to be needed to collect wastewater from this area and to deliver it to the centralized treatment plant. It asserts that the required facilities consist of 15,800 linear feet of collection main and 2 lift stations. The projected cost of these facilities is $5.6 million, not including any costs of easement acquisition, plus $1.25 million for engineering, surveying and geotechnical investigations, yielding a total cost of $6.85 million. Not included in these projected costs for providing wastewater service to this area is the cost of treatment plant expansion to accommodate the projected flow and the cost of all collection lines, and perhaps lift stations, within each development and/or to route flows from a development to one of the trunk mains. Nor does it include any costs for routing flows from the lift stations to the current treatment plant location. Therefore, the projected cost represents only a partial cost of solely collecting the wastewater from the area and taking it "away" to a point within the current collection system within the city limits.

The report also addresses routing of treated effluent – reclaimed water – from the current treatment plant location to the defined service area for reuse. The facility for this is asserted to be 15,800 linear feet of reclaimed waterline. The projected cost of this line is $1.1 million, with a note that "cost does not include design, survey, geotechnical investigations, easement acquisition or construction cost for pump station/elevated storage". Therefore, this cost too is a very truncated estimate of the total cost of attaining a reuse benefit from the reclaimed water, as it omits not only the items noted but also any facilities to actually disperse and utilize this water within or around the developments.

DECENTRALIZED CONCEPT SYSTEM COST FACTORS

The costs of the facilities to implement the decentralized concept wastewater management strategy would vary with the nature of the development, the topography of the site, opportunities for reuse, etc. The approach for this analysis is to use the costs derived in a review of an example decentralized concept system. The area is shown in Figure 1. The system includes collection from a defined tributary area, a distributed treatment unit, and dispersal for irrigation reuse within that area. The estimated rough cost of those facilities is shown in Table 1.

Example Subdivision Decentralized Concept "Waste" Water System
Figure 1

To create an "apples-to-apples" comparison of the decentralized concept facilities with the collection facilities set forth in the Smith Turrieta report, the costs for just the collection system are extracted from Table 1. These costs include the interceptor tanks and the effluent sewer collection lines. Based on the layout of the example subdivision in Figure 1, the total interceptor tank cost is $117,500 plus $42,000, or $159,500, and the total cost of the effluent sewer lines is $124,400, including sleeve pipes for street crossings. This yields a total collection system cost of $283,900. Spread over the 115 homes in the example subdivision, the cost per house would be $2,468.70. This may be multiplied times the number of houses, or "house equivalents" (the flow generated by other development divided by the nominal per house flow, noting that the nature of that development is likely to impart a somewhat lower collection system cost per "house equivalent") to estimate the collection system cost in each of the areas defined in the Smith Turrieta report, if that were of interest.

Note however that the decentralized concept collection system is the collection system ***within*** the development. There would be ***no*** trunk mains or lift stations external to the development, which are the facilities set forth in the Smith Turrieta report. It is clear therefore that employing the decentralized concept strategy would obviate the ***entire*** $6.85 million cost of those trunk mains and lift stations.

It remains to determine how the cost of the decentralized concept collection system would compare with the cost of conventional collection systems ***within*** the developments plus any lines and lift stations that would be required to route the flow from the development to one of the trunk mains. This too would depend on the nature of the development, area topography, etc., but in other comparisons it has been found that the cost of the interceptor tanks and effluent sewers is similar in cost to just the conventional collection lines within the development. So taking into account costs for facilities outside the development boundaries, it is rather likely that overall cost of these local collection system facilities would be somewhat lower under the decentralized concept than it would be for a centralized system.

Table 1

Blanco Area Example Subdivision

Decentralized Concept Wastewater System Cost Summary

Number of lots (houses) =	115			
Presumed system design flow rate =	25,000	gpd	217	gpd/house
Item Description	Quanity	Units	Unit Price	Total Cost
Collection and Treatment System				
Treatment plant	25,000	gpd	$ 25.00	$ 625,000
House drain connection	115	each	$ 500.00	$ 57,500
1,500-gallon interceptor tank	47	each	$ 2,500.00	$ 117,500
1,000-gallon interceptor tank	21	each	$ 2,000.00	$ 42,000
Effluent sewer line	7,500	l.f.	$ 15.00	$ 112,500
Street crossing sleeve pipe	1,190	l.f.	$ 10.00	$ 11,900
Total installed cost of collection and treatment system =				$ 966,400
Collection and treatment system cost per house =				$ 8,403
Reuse/Dispersal System				
Effluent redistribution pipe	6,100	l.f.	$ 2.00	$ 12,200
Drip irrigation field drip hose array	200,000	sq. ft.	$ 2.00	$ 400,000
Drip irrigation field entry assembly	40	each	$ 150.00	$ 6,000
Drip irrigation field flush valve assembly	40	each	$ 150.00	$ 6,000
Total installed cost of effluent redistribution and reuse/dispersal system =				$ 424,200
Effluent redistribution and reuse/dispersal system cost per house =				$ 3,689
Total installed cost of decentralized concept wastewater system =				$ 1,390,600
Average cost per house of decentralized concept wastewater system =				$ 12,092.17

Before proceeding, note that the “bottom line” cost shown in Table 1 of about $12,000 per house is for a ***total*** system – collection, treatment ***and*** reuse, including both the reclaimed water delivery line ***and*** the irrigation systems. Again, the Smith Turrieta report considered only the large-scale collection facilities and a reclaimed water “trunk” line.

The cost of the reuse “trunk” line evaluated in the Smith Turrieta report can be compared with the estimated cost of the effluent redistribution pipe in Table 1. (Note that an effluent pump station is already covered in the estimated cost of the treatment unit generating the reclaimed water.) The total flow generated in the study area set forth in the Smith Turrieta report is about 1,478,510 gpd (shown in Table 2). At the nominal flow rate per house of 245 gpd, this is about 6,035 “house equivalents”. This yields a cost for just the reuse “trunk” line of $1,100,000/6,035 = $182/house.

From Table 1, the approximate cost of the local area reuse redistribution line for the decentralized concept system is $12,200/115 = $106/house. Note however that this cost is all ***within*** the development, for facilities which would ***also*** have to be provided under the centralized strategy in addition to the reuse “trunk” line set forth in the Smith Turrieta report. So here again the relevant comparison is ***zero*** cost for any large-scale redistribution lines for reuse in the decentralized concept systems vs. $182/house for the conventional centralized system.

The other piece of information requested by POB is an estimate of the number of distributed treatment units that might make up the overall decentralized concept wastewater system, an estimate of the total cost of the distributed treatment units, and a review of implications for O&M costs. Table 2 shows the calculations to derive a probable number of treatment centers in each of the 14 areas defined in the Smith Turrieta report. These calculations presume the following:

- Within the decentralized concept strategy, it is presumed that all large-lot residential development would have wastewater managed with OSSFs (On-Site Sewage Facilities, the regulator-speak for what are popularly called “septic systems”). Therefore, the flow generated by that development is subtracted from the total flow from each area to estimate the number of treatment centers that would be required.
- Other development that is of very limited extent, resulting in flows of less than 5,000 gpd, are also likely to have the wastewater managed by OSSFs, in particular if these flows are from the only land uses in the area. These flows are also subtracted from the total flow from each area.
- The nominal size of a distributed treatment center is presumed to be 25,000 gpd. This can readily be varied up or down, but since it is the basis of the decentralized concept cost estimates shown in Table 1, this is used for this analysis. The “residual” flows, after subtracting those expected to be managed with OSSFs, in each area are divided by 25,000 gpd to estimate the number of distributed treatment units in that area.

From Table 2, the total number of distributed treatment centers that would be required to serve the projected flows in each area is 56 treatment centers. From Table 1, the estimated cost of a 25,000 gpd treatment center, at an estimated unit cost of $25/gpd of capacity, is $625,000. This yields an estimated cost for all the distributed treatment centers of about $35 million.

Table 2
Wastewater Flow Estimates from Areas Set Forth in Smith Turrieta Report
and Equivalent Decentralized Concept Treatment Units

AREA 1

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, 4 ac. lot	123 houses	280 gpd/house	34,440 gpd
Office Buildings	65.36 acres	195 gpd/acre	12,745 gpd
Industrial Buildings	138.89 acres	52 gpd/acre	7,222 gpd
		Total flow rate in area =	54,407 gpd
		Flow likely to be collected =	19,967 gpd

Number of treatment units = 19,967/25,000 <1 – 1 treatment center

Table 2 (cont.)

AREA 2

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, 4 ac. lot	11 houses	280 gpd/house	3,080 gpd
Shopping Center	21.20 acres	126 gpd/acre	2,671 gpd
Office Buildings	21.20 acres	195 gpd/acre	4,134 gpd
		Total flow rate in area =	9,885 gpd
		Flow likely to be collected =	6,805 gpd

Number of treatment units = 6,805/25,000 <1 – 1 treatment center

AREA 3

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, 4 ac. lot	1 house	280 gpd/house	280 gpd
Industrial Buildings	74.62 acres	52 gpd/acre	3,880 gpd
Stables/Kennels	74.62 acres	13 gpd/acre	970 gpd
		Total flow rate in area =	5,130 gpd
		Flow likely to be collected =	0 gpd

Number of treatment units: All development served by OSSF

AREA 4

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, ¼ ac. lot	680 houses	245 gpd/house	166,600 gpd
		Total flow rate in area =	166,600 gpd
		Flow likely to be collected =	166,600 gpd

Number of treatment units: 166,600/25,000 = 6.7 – 7 treatment centers

AREA 5

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, ¼ ac. lot	894 house	245 gpd/house	219,030 gpd
Single Family Homes, 4 ac. lot	56 house	280 gpd/house	15,680 gpd
		Total flow rate in area =	234,710 gpd
		Flow likely to be collected =	219,030 gpd

Number of treatment units: 219,030/25,000 = 8.8 – 9 treatment centers

AREA 6

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Industrial Buildings	36.03 acres	52 gpd/acre	1,874 gpd
Stables/Kennels	6.36 acres	13 gpd/acre	83 gpd
		Total flow rate in area =	1,957 gpd
		Flow likely to be collected =	0 gpd

Number of treatment units: All development served by OSSF

AREA 7

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, ¼ ac. lot	466 houses	245 gpd/house	114,170 gpd
Multi-Family Homes	116.48 acres	1,950 gpd/acre	227,136 gpd
		Total flow rate in area =	341,306 gpd
		Flow likely to be collected =	341,306 gpd

Number of treatment units: 341,306/25,000 = 13.7 – 14 treatment centers

Table 2 (cont.)

AREA 8

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Multi-Family Homes	28.68 acres	1,950 gpd/acre	55,926 gpd
Motel with kitchen	13.39 acres	2,000 gpd/acre	26,780 gpd
Shopping Center	57.37 acres	126 gpd/acre	7,229 gpd
Restaurant	5.74 acres	600 gpd/acre	3,444 gpd
Office Buildings	47.81 acres	195 gpd/acre	9,323 gpd

Total flow rate in area = 102,702 gpd
Flow likely to be collected = 102,702 gpd
Number of treatment units: 102,702/25,000 = 4.1 – 4 treatment centers

AREA 9

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Multi-Family Homes	69.64 acres	1,950 gpd/acre	135,798 gpd
Office Buildings	23.21 acres	195 gpd/acre	45,260 gpd

Total flow rate in area = 181,058 gpd
Flow likely to be collected = 181,058 gpd
Number of treatment units: 181,058/25,000 = 7.2 – 7 treatment centers

AREA 10

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, 4 ac. lot	21 houses	280 gpd/house	5,880 gpd
Office Buildings	9.29 acres	195 gpd/acre	1,812 gpd

Total flow rate in area = 7,692 gpd
Flow likely to be collected = 0 gpd
Number of treatment units: All development served by OSSF

AREA 11

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Industrial Buildings	17.07 acres	52 gpd/acre	888 gpd

Total flow rate in area = 888 gpd
Flow likely to be collected = 0 gpd
Number of treatment units: All development served by OSSF

AREA 12

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, ¼ ac. lot	844 houses	245 gpd/house	206,780 gpd
Single Family Homes, 4 ac. lot	41 houses	280 gpd/house	11,480 gpd
Multi-Family Homes	28.14 acres	1,950 gpd/acre	54,873 gpd
Motel with kitchen	9.38 acres	2,000 gpd/acre	18,760 gpd
Shopping Center	46.90 acres	126 gpd/acre	5,909 gpd
Restaurant	9.38 acres	600 gpd/acre	8,442 gpd

Total flow rate in area = 306,244 gpd
Flow likely to be collected = 294,764 gpd
Number of treatment units: 294,764/25,000 = 11.8 – 12 treatment centers

Table 2 (cont.)

AREA 13

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, ¼ ac. lot	181 houses	245 gpd/house	44,345 gpd
Single Family Homes, 4 ac. lot	28 houses	280 gpd/house	7,840 gpd
Shopping Center	45.32 acres	126 gpd/acre	5,710 gpd
		Total flow rate in area =	57,895 gpd
		Flow likely to be collected =	50,055 gpd

Number of treatment units: 50,055/25,000 = 2.0 – 2 treatment centers

AREA 14

Type of Development	Units of Development	Flow Rate Criterion	Total Flow for Usage
Single Family Homes, 4 ac. lot	28 houses	280 gpd/house	7,840 gpd
Stables/Kennels	15.05 acres	13 gpd/acre	196 gpd
		Total flow rate in area =	8,036 gpd
		Flow likely to be collected =	0 gpd

Number of treatment units: All development served by OSSF

Total Smith Turrieta projected flow from service area = 1,478,510 gpd

Total flow projected to collected (other than OSSF management) = 1,382,287 gpd

Probable number of ~25Kgal/day distributed treatment centers = 56

ANALYSIS

It is expected that having 56 treatment centers to police would be seen as a large O&M liability, relative to the effort required to operate and maintain one centralized treatment unit. First it is understood that sizing the distributed treatment centers at ~25,000 gallons is arbitrary. As noted, the degree to which any given area is collectivized would depend on local factors, such as the nature of the development, the area topography, opportunities for reuse of the reclaimed water, etc. But there is no "natural" limit to the size of a treatment center, so the actual number of treatment units may be somewhat lower than 56.

However, the distributed treatment units, employing the very robust recirculating packed-bed technology, would basically operate day-to-day without any need for operator intervention. Various routine O&M activities would be executed about quarterly or semi-annually. As long as there would be remote monitoring of any alarms – these would be mainly to signal a pump failure, expected only at multi-year intervals, but the treatment centers would employ duplex pump systems, so even those alarms would not demand immediate attention – there would be no need to visit each treatment center any more often than it would be required under the permit terms to collect water quality samples. It may be expected that the maximum frequency for this would be once per week, but this frequency may be once per month – at least after the stability of these treatment units have been demonstrated to TCEQ's satisfaction.

Even if the required frequency at which a treatment center would need to be visited is weekly, the number of treatment units that would have to be visited each weekday would be 56/5 = 11.2 per day. One person could readily collect water quality samples from 11 treatment centers each day. But as noted there would also be routine O&M activities to conduct periodically, and arrangements would need to be made to transport the samples to a testing laboratory. Thus it is expected that two persons would be needed to provide O&M operations if sampling were to be required weekly.

If, as expected, that requirement were relaxed to monthly, assuming 22 working days per month, the number of treatment units that would have to be visited each working day would be 56/22 = 2.5 per day. In this case, one person could readily collect samples and transport them to a laboratory, ***and*** conduct the routine O&M operations. Likely it would be deemed efficient to collect samples one day per week, requiring sampling at 2.5 x 5 = 12.5 units – so 12 or 13 units each week – so that transport to the lab could be done only once per week. We see therefore that having to police this number of treatment units would not be an untenable O&M liability.

The $35 million price for the treatment centers is also likely to be a concern. To put this in context, from the "Technical Memorandum" issued in 2016 by Jones & Heroy on the expansion of the City of Blanco centralized treatment plant, it can be derived that the unit cost of the centralized plant is about $16/gpd. So for the planned "final" phase plant size of 1.6 Mgd, the total cost would be about $25.6 million. This indicates that installing distributed treatment centers instead of expanding the centralized plant would impart a "premium" of about $9.5 million. But as reviewed above, the decentralized concept strategy would obviate all the large-scale collection and redistribution lines and lift stations that are the subject of the Smith Turrieta report. The total projected cost of these facilities is approximately $8 million, and as has been noted, this cost omits a number of items that would no doubt drive the total cost somewhat higher. It may be concluded therefore that, taking into account those avoided costs, the cost of collection and treatment would be a "wash" between the centralized and decentralized concept options.

The "time value of money" however tips the comparison in favor of the decentralized concept. The investments in the centralized system are all required ***up front of serving any development***, and these facilities are sized for ultimate development they are expected to serve. Thus money must be spent today that won't be fully utilized for many years. The decentralized concept facilities, in contrast, would be built on a "just in time" basis to serve only imminent development, so the money need be spent only shortly before the development it serves comes on line. This leaves the money not needed in the short term free to use for other investments that don't need to lie fallow for many years. That creates a global cost advantage for the decentralized concept approach.

Likewise, with the cost of wastewater system investments much more closely tracking the progress of development, far less money would be put "at risk". An investment that may not be fully utilized for many years depends of course on the predicted development actually coming on line. While the course of growth in the Blanco area may seem a sort of "manifest destiny", there are various things that may blunt the growth, such as another economic "crash" like was experienced in 2007-2008, a pandemic such as is feared at the present, and so on. If there were to be a hiatus in growth, blunting development in this study area, the existing citizenry and/or the existing ratepayer base would have to endure higher taxes and/or rates to pay off the loans/bonds used to finance the infrastructure. Under a decentralized concept strategy, again the investments in wastewater system infrastructure would be incurred only for a development that ***is*** hitting the ground, so there would be far less money "at risk". In any case, most of the decentralized concept facilities would be financed directly by the development principals rather than publicly financed, so for the existing citizenry/ratepayer base, very little if any money would be "at risk".

SUMMARY

The following observations are offered about pursing the conventional centralized strategy vs. a decentralized concept strategy to provide wastewater service to the defined study area:

- Under a decentralized concept strategy, all of the facilities reviewed in the Smith Turrieta report would be obviated, relieving the City of Blanco of about $8 million in explicitly identified publicly-financed infrastructure. As noted, not insignificant additional costs were not evaluated, so the total cost for ***just*** the "trunk" collection system and reclaimed water distribution "trunk" line to completely serve the study area is likely well over $10 million.

- Instead, developers would directly fund the installation of the collection system, treatment units and the reuse systems within the development. All those facilities would be "local", and would serve only imminent development. Clearly, the developers would not set forth those investments unless they were very close to putting their development on the ground, so far less money, from ***any*** source, would be "at risk".

- Based on the projections of development, and resulting wastewater flows, set forth in the Smith Turrieta report, a total wastewater flow of about 1.5 Mgd would be generated within the study area. Under a decentralized concept strategy, some of that development would be expected to use OSSFs for wastewater management, so about 1.4 Mgd would flow to collective systems. To accommodate that flow, about 56 treatment centers, each receiving about 25,000 gpd, might be installed.

- Because a very robust, inherently stable, treatment technology would be employed in distributed treatment centers, the operations and maintenance of many centers would be no more onerous or difficult than operating and maintaining the centralized treatment plant.

- The projected total cost of those treatment centers is about $35 million. The projected cost of the 1.6 Mgd centralized treatment plant is about $25.6 million, so the decentralized treatment centers would in total cost about $9.5 million more.

- This would be offset – likely more than offset – by the avoided costs of the conventional centralized collection system and reclaimed water redistribution lines and pump stations.

- The timing of investments required under each approach creates a significant cost advantage for the decentralized concept strategy. Investment would only be dedicated to serve imminent development. As noted, development principals would largely pay for those investments directly, rather than through a public financing scheme, like loans or bonds, paid back by rates and/or taxes. This would relieve the general citizenry and/or ratepayer base of any risk that the projected development would not come on line and so pay the fees that would be depended upon to pay off the loans or bonds.

- Neither the Smith Turrieta report nor the Jones & Heroy Technical Memorandum sets forth a global cost of an entire wastewater system, so the total cost of collection, treatment ***and reuse***, including all collection lines and reuse facilities within developments, under a conventional centralized strategy remains to be derived. Once that is done, it can be compared to the "bottom line" rough estimate for a ***complete system*** – for a residential development – of about $12,000 per house under the decentralized concept strategy. To serve other types of development, it is to be expected that the cost per "house equivalent" would be less, depending on the nature of the development.

- It is expected that the total operations and maintenance costs for the decentralized concept strategy would be less than for a conventional centralized system. The manpower requirement are expected to be about the same, given that no maintenance of trunk mains and lift stations would be required under the decentralized concept strategy, but the energy costs for the decentralized concept systems would be considerably less than for the centralized system.

- Therefore, a global cost accounting is very likely to significantly favor the decentralized concept strategy.