Technical Memorandum Name: **Flow and Loads, March 2008**
Commenter: **Michael Saunders**
Comments Date: **May 5, 2008**
Responses Date: **September 30, 2008**

The following comments were submitted in response to the above listed Technical Memorandum (TM). The TM was developed as part of the EIR process for the project, in order to help facilitate and broaden the discussion of project issues important to the community. The responses should be considered preliminary because the EIR process is not complete, and the information necessary to fully respond has not yet been developed. The project team is grateful to those citizens who took the time to review the TM and provide comments at this early stage in the process. The project team will endeavor to fully address the comments and concerns through the on-going project development process.

	Comment	Response
1	Flows and Loads dated February 2008. We offer the following comments and/or concerns for consideration: ***I. Following is a direct quote from section 3.1 of the Flow and Loadings Tech Memo:*** "Gravity sewers utilize bell and spigot joint construction. Properly installed bell-and-spigot sewers will be watertight at first, and then may slowly lose their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints." **Comment: We believe that the Fine Screening Analysis eliminates a bell and spigot joint gravity sewer technology as a viable option. The Fine Screening Analysis (page 1-6) states that a "viable project" could not result in an increase in the groundwater balance deficit, maintaining the existing basin balance (i.e. level 1) was considered the minimum viable project."** In support of our belief, we offer the following observations: • The sentence containing the statement, "compromising their seals at the joints," depicts groundwater as the source for I/I. • The Fine Screening states that the **newly constructed** gravity collection system can expect 300,000 gallons per day of wet weather infiltration and inflow (Table 1.2 page 1-10). This number represents a minimum I/I volume acceptable for new construction standards, and does not account for settling and aging resulting in additional infiltration and inflow. Additionally, this number would not include dry weather infiltration that would be associated with the miles of submerged gravity sewer pipe. • In essence over the life cycle of the system, I/I ***risk*** is very high and will never get better only worse. • Over the systems life cycle, the gravity sewer collection system will pump an un-quantified number of acre feet per year of groundwater out of Los Osos' shallow aquifer that will ultimately be run through the treatment plant. Within the context of the Fine Screening this is defined as a groundwater balance deficit. This brings to light four significant points: o The Carollo Engineering proposed gravity sewer system results in an increase in the groundwater balance deficit; therefore it does not meet the criterion used in the Fine Screening analysis to be a	The Fine Screening Report does not preclude gravity collection systems. The report, and this TM, establishes that any collection system is susceptible to I/I, and that I/I must be considered in the analysis of collection, treatment, and disposal capacity. The Fine Screening Report identifies several Project options that include gravity collection and mitigate seawater intrusion.

	"viable project." o The gravity sewer groundwater balance deficit is unaccounted for in the sea water mitigation study both in magnitude and in cost. o It appears that fusion-welded PVC is the only solution that will make gravity sewer a "viable project." This cost is unaccounted for. o The long-term ***risk,*** or potential magnitude of I&I is not quantified in any way. Given the goals and objectives for this project, it is inevitable that Los Osos will eventually be looking at methods for mitigating the impacts of I&I in the Los Osos water basin.	
2	***II. Following is a quote from section 6.0 of the Flow and Loadings Tech Memo:*** "Inflow/infiltration (I/I) estimates for the collection system alternatives were the main source of uncertainty in calculating the future treatment facility influent flow volume. If a gravity collection system is selected, only a system that was constructed of fusion-welded PVC piping could be operated with as little I/I as the other types systems. However, fusion welded PVC sewers are a fairly new technology with little long term operating history, and can be significantly more costly to install than traditional bell-and-spigot gravity sewers." **Comment: This quote illustrates a double standard when comparing technology options. While every effort was made to establish costs for "high-end" quality STEP system, the cost of fusion welded PVC gravity sewer was not discussed nor quantified in any way. When the range of potential costs for STEP and gravity sewer were overlapped, the "high-end" potential costs for STEP appeared to be utilized in an effort to minimize the capital cost differential between it and a "low-end" gravity system cost. Had costs for a "high-end" gravity sewer system been quantified, the differential in costs would have been much more discernible.** The "high-end" STEP System cost includes every single cost that could possibly become applicable without any discussion on how unlikely or how practical these costs would be. There was no effort to dismiss any material selection or construction technique on the premise that it would be "significantly more costly". We promote the construction of water-tight STEP systems despite the fact that lower cost leaking tanks could produce a lower cost system. In fact, we could promote the use of the existing septic tanks if our sole goal was to provide the lowest cost STEP system. At no time have we promoted, nor have we even considered, compromising the quality of our STEP systems because it was too costly. Similarly, we believe that a gravity sewer system can be designed and constructed with the intent of mitigating I/I to the fullest extent possible. These costs should be determined, quantified and compared so that we are truly doing an apples-to-apples comparison of technologies.	Gravity and STEP collection systems have inherent variability in their potential for I/I. This variability has been factored into the calculations and cost estimates for collection, treatment, and disposal capacity. The cost estimates for gravity collection have been established through competitive bidding on a 100% design and have a high degree of certainty. Cost estimates for a STEP system are much less certain, due to the lack of a detailed design. The uncertainties in cost estimates are expected to be resolved through the design-build contracting process.
3	***III. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:*** "However, a treatment plant should be designed to accommodate a reasonably conservative level of inflow and infiltration (I/I)." ***Comment:*** **To further complicate the gravity sewer collection challenges, the final Fine Screening did not reflect the true cost impacts of sea/ground water infiltration into the gravity**	Sea water intrusion is not expected to be an issue with any collection system, because it is not expected to occur in the **upper** aquifer as a result of ceasing septic tank discharges. There is sufficient

	sewer line, which can adversely impact beneficial reuse, sea water intrusion mitigation, and crop irrigation. • Sea water contains approximately 35,000 mg/L Total Dissolved Solids including approximately 18,000 mg/L of Chlorides. It is documented that nitrifying and denitrifying bacteria are inhibited with increasing concentrations of chlorides. (See attachment, EPA Guidance Manual for Preventing Interference at POTW's, Table 2-1.) A high tide during low flow conditions could easily produce conditions toxic to both nitrifiers and de-nitrifiers. • High chloride effluent would also limit the beneficial reuse of treated effluent for crop irrigation. (Asano, T., F. L. Burton, H. Leverenz, R. Tsuchihashi, and G. Tchobanoglous (2007) *Water Reuse: Issues, Technologies, and Applications*, *McGraw-Hill, New York*.) • It is highly likely that in order to reuse the high chloride/total dissolved solids gravity sewer effluent beneficially; Reverse Osmosis would be needed, to remove the chloride and other constituents of concern. This cost is un-accounted for. • A rough cost example is provided using the Wisconsin Dept. of Natural Resources rough estimate worksheet. Chloride removal technology could cost an additional $1,575,000 in capital costs and $511,000/year in O&M. (See attachments, Wisconsin Dept. of Natural Resources, Chloride Variance Information and Worksheet) • The Fine Screening does not quantify the possible gravity sewer exfiltration of raw untreated wastewater contain into Los Osos' sensitive receiving environment.	hydraulic pressure to maintain a fresh water balance in the upper aquifer. Sea water intrusion is occurring in the **lower** aquifer.
4	***IV. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:*** The Fine Screening Report recommended an I/I allowance of 0.3 mgd additional flow for the average monthly wet weather flow. This value was derived from an average infiltration allowance of 530 gpd/acre, (with a service area of 595 acres), which is appropriate for sewer systems with precast manholes and rubber-gasketed joints (Metcalf and Eddy, 1981). ***Comment:*** **The recommended allowance of 0.3 mgd represents the allowable leakage for newly installed gravity sewer pipe. Essentially, it is the allowable leakage when testing *newly* installed gravity sewer for construction acceptance. This leakage does not include inflow, leakage into manholes nor I&I from on-site laterals. We would contend that this number does not necessarily define I&I nor does it quantify the potential *risk* of I&I increasing relative to the age of the systems.**	The I/I allowance in the Fine Screening Report and tech memo is conservative. It is based on literature (Table 4) and on operating information from other communities (Table 5). The value is comparable to the Metcalf and Eddy values from 1981, which assume other pipe materials such as clay and concrete. The allowance is 400% more than the recommendations in recent literature.
5	***VII. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:*** However, communities with excessive I/I often are those with sewer systems dating from an era before modern sewer construction techniques and materials. Page 6 ***Comment:*** **The example of the City of Lathrop, CA. dispels the myth that modern construction techniques and materials have less I&I.** The City of Lathrop, California is an example of a relatively **new PVC gravity sewer** system that is experiencing extensive I&I. Below, the lower graphic shows the increase in flow for the San Joaquin River that is attributable to a rain event. In the graphic that shows wastewater and water flow, the correlation between the wastewater flow and a rain event (documented in the	The charts presented show river flows for the months of Dec. and Jan. and sewer flows from Jan. to July. There is no increase in sewer flows that corresponds with the increased river flows in Jan. and Feb. Additionally, the project team researched Lathrop and spoke to city staff. There are areas with older clay pipe and areas with PVC, and the city is currently in a lawsuit with a

	river flow) is clearly evident. It should also be noted that the wastewater flow increase was independent of the water consumption. The impact of I&I is now causing impacts in treatment and capacity that will be costly to the Utility rate payers of that City. (charts)	private developer over a recently installed area of the collection system. An overflow of a pressure main about 5 years ago resulted in fines. The cause was determined to be a failed pipe fitting at an air release valve.
6	***VIII. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:*** Table 4 shows a range of infiltration factors developed by various textbooks and other references. These represent I/I rates of older sewer systems. The I/I expected in a brand new system would be an order of magnitude lower than these values, and increase to these levels over a period of decades. The gravity sewer infiltration allowance used in this TM is greater than most of the rates suggested in these other references. It is therefore a conservative estimate. **The ADWWF expected for the wastewater treatment plant with a gravity collection system is 1.4 mgd** (1.1 mgd ADDWF, plus 0.3 mgd average I/I). ***Comment:*** **The table, generated from Text Books, is clearly intended to provide validity to the I&I estimate that was utilized. Furthermore, the table would appear to assure the reader of this memorandum that the I&I estimates are far more conservative than they probably need to be. Unfortunately these values for I&I are not necessarily quantifications of gravity sewer I/I. These volumes generally represent the allowable leakage when testing *newly* installed gravity sewer for construction acceptance. Pipe leakage is a small portion of the overall I&I. I&I also includes leakage into manholes, inflow into manholes and I&I on private property. Additionally, I&I is affected by material specification, construction standards, construction quality. Also, I&I will assuredly increase relative to the system age.** If we review text books for the true definition of I&I, we will find that long term I&I is highly variable and that the possible ranges for long term I&I are somewhat startling. The referenced source for the definition of I&I, "Wastewter Engineering, Treatment and Reuse", Metcalf & Eddy, 2003, states that "the amount of water that can enter collection systems from groundwater, or infiltration, may range from 100 to 10,000 gal/d·in-mi or more". It also goes on to state that in terms of service area the range can be 20 to 3000 gal/ac·d on average and can be as high as 50,000 gal/ac·d during heavy rains. The same book also states that collection systems exhibiting infiltration also may exhibit exfiltration. The I&I expectation should not be a referenced value from Metcalf & Eddy as has been presented, without a serious discussion regarding the potential impacts of I&I at higher than expected levels. While the quantity of 530 gpd/acre *may* be an appropriate approximation of I&I, given the goals and objectives of this project, it is very important to discuss the potential *risk* associated with I&I in a bell & spigot gravity sewer system. The discussion of risks associated with I&I should include the potential for spills, sewer back-ups, changes in wastewater quality as well as the possible costs for fixes should excessive I&I occur.	The I/I allowance is conservatively based on literature (Table 4) and on operating information from other communities (Table 5). The tech memo also includes a Sensitivity Analysis in Section 7 which considers the potential impacts on the treatment process due uncertainties in flow and load estimates. Any collection system technology, whether gravity, STEP or other, has risks that must be mitigated through proper planning, construction quality control, and ongoing maintenance. Potential environmental risks of each collection system alternative will be evaluated in the EIR.

7	***IX. Following is a quote from section 3.2 of the Flow and Loadings Tech Memo:*** With new septic tanks where drains and runoff are diverted away from the area around the tank, the I/I presumably would be much lower than that estimated for a gravity collection system. The major source of I/I in a STEP sewer is the tank and the connection to the house. I/I into the tank will be retained there and will not immediately translate into peak flows to the treatment plant. Based on these factors, average I/I is estimated to be 0.1 mgd. ***Comment:*** **Onlot I/I in a STEP system can be detected early and corrected prior to any warranties etc. running out. Watertight structurally sound tanks with watertight connections that are tested in place during construction is a necessary standard. Web based monitoring controls can detect any compromise to this watertight standard. The same is not true for gravity sewer laterals to the home.** For comparison, all technologies must meet the same "watertight" standard, and for each there is a cost associated with that standard. For gravity sewer it's the cost of fusion welded PVC pipe, for low pressure grinder systems it's the cost of fiberglass pump basins, for STEP systems it's the cost of watertight/structurally sound STEP tanks.	An estimated I/I allowance of 0.1 MGD for STEP for the life of the project is approximately 20 gallons per day per connection. This is a conservative estimate and it is not reasonable to assume that small leaks would be detectable or cost effective to correct.
8	***X. Following is a quote from section 3.3 of the Flow and Loadings Tech Memo:*** A low pressure sewer would have many of the same characteristics as a STEP sewer, except that some of the lines would have a smaller diameter in some places due to the need for the wastewater to obtain cleaning velocities. Additionally, in a low pressure sewer, homes would have a small grinder tank rather than a large septic tank, which would presumably be less susceptible to inflow. However, these smaller tanks also have less capacity to equalize flow compared to STEP tanks. Therefore, the average I/I for low pressure sewers is estimated equivalent to a STEP sewer, which is 0.1 mgd with a peak I/I of 0.16mgd. The PHWWF expected for a low pressure sewer is 1 .8 mgd; **therefore the PHWWF for a low pressure sewer is expected to be 1.9 mgd.** ***Comment:*** **The average I/I for STEP and low pressure sewer will only be equivalent if materials of construction for low pressure sewer are structurally sound and watertight. A very prominent grinder pump manufacture is being sued by a county in Michigan over poor quality, leaking grinder pump chambers.** While we agree that STEP tanks will reduce peak flows when compared to a grinder pump tank, we do not concur on the assumption that I&I will be lower. I&I at the tank is more a function of tank quality than tank size. Orenco specifies and assures that a tank will be watertight. Tanks are generally molded fiberglass or may be concrete if constructed to strict standards provided by Orenco. Orenco's strict policies regarding water-tight ranks, does not necessarily reflect on all manufactures of STEP and grinder pump systems. Many grinder pump tanks are manufactured from either HDPE or fiberglass. Typically, the HDPE tanks are marketed at a much lower cost than the fiberglass pump tanks. The HDPE tanks have a tendency to flex under certain stresses. The flexure within HDPE	Grinder pump vaults would be required to be watertight and structurally sound. They also have less volume and surface area than STEP tanks and only one manhole compared to two manholes with each STEP tank. It is therefore, conservative to estimate similar I/I rates for grinder pump and STEP systems.

	tanks has been documented to cause leakage at pipe intrusions and at hatch openings. When comparing Fiberglass tanks it is very important to compare the quality of the fiberglass construction. Orenco utilizes a patented molding process to build fiberglass tanks that will assure consistent wall thickness and consistent fiberglass composition. Inferior fiberglass construction can often result in pump tanks that are susceptible to structural failure, delamination or wicking.	
	XI. Following is a quote from section 4.0 of the Flow and Loadings Tech Memo: The EPA (Amick, 2000) reports that exfiltration rates in leaking sewers are related to the relative depths of the sewer lines to the groundwater table, with greater depth to groundwater leading to higher rates of exfiltration. The groundwater table in Los Osos is high (less than 5 feet deep in some areas), so exfiltration is expected to be limited. ***Comment:*** **The Infiltration and Exfiltration comments contained in this memo are contradictory. If as this quote suggests, exfiltration is limited because of high groundwater depth, then are the lines submerged? It is true that groundwater hydrostatic pressure will mitigate exfiltration, it will also exacerbate infiltration. Either the lines are submerged or they are not, an exception maybe pipes installed under the tidal influence that will produce both conditions.** ***Below is a quote taken from the conclusion of the same EPA (Amick, 2000) report:*** Areas with significant portions of the system above, but in close proximity to, the groundwater table are probably at greatest risk. There is an increased risk in the relatively few areas with significant exfiltration potential when there is, for example, a thin soil and fractured rock hydro geologic setting which allows pathogens and other contaminants from the sewage to reach the ground water quickly and with minimal attenuation. Page 25. In the context of the Los Osos project Amick details the ***RISK*** to ground water quality when a leaky technology is specified. The June 2006 LOCSD report entitled "Los Osos Upper Aquifer Water Quality Characterization included the following table regarding the characterization of the 5 test wells that were utilized in the study" (table) Please note that 3 out of 5 wells clearly show water depths that are below the depth of a gravity sewer system. This study was done by Cleath & Associates, who was also the sub consultant for the Fine Screening Analysis that was done by Carollo Engineering. The Fine Screening Analysis stated that the true value of I&I would "probably be much lower due to the sandy soils in the region that tend to direct water past the trench". More appropriately, it would appear reasonable to state that areas with high water tables have less risk of exfiltration but ***are at high risk*** for excessive groundwater infiltration. Conversely, it appears that there are areas with deep water tables and sandy soils that appear at risk for impact from exfiltration. The Memorandum and the Fine Screening analysis appear to lose credibility through contradictory findings.	When considering exfiltration (instead of infiltration) the EPA study suggests that area of high groundwater limit the potential for exfiltration. For Los Osos the depth to groundwater will vary throughout the community. For any collection system technology proper planning, construction quality control, and ongoing maintenance are important for preventing exfiltration and spills. Potential environmental risks of each collection system alternative will be evaluated in the EIR.

	XI. Following is a quote from section 4.0 of the Flow and Loadings Tech Memo: **In the case of exfiltration, the wastewater entering the groundwater would be higher in BOD and solids in a gravity or low pressure sewer compared with a STEP sewer. However, in Los Osos the major concern for groundwater quality is nitrogen. Wastewater flows from each type of sewer would have approximately the same concentration of nitrogen.** ***Comment:*** Nitrogen has been a focal point for the groundwater quality because potable use of the shallow aquifer currently requires treatment to reduce nitrogen and/or the blending of water from deeper aquifers with the intent of diluting the nitrogen concentration The risk of discharging wastewater with high BOD, TSS, oils and greases and possibly chemicals or pathogenic organisms should not be dismissed without consideration as any and all of these constituents will be detrimental to groundwater quality. Also, the discharge of these elements into the shallow aquifer can also necessitate additional treatment or blending. Furthermore, at its worse, the threat of chemical contamination could compromise the use of the shallow aquifer for potable water altogether. As an example, Modesto Groundwater Pollution is listed on the EPA Superfund Site with groundwater pollution caused by PCE exfiltration. The PCE originates from a Dry Cleaner discharging to a leaky gravity sewer. The information, as contained on the EPA web site follows: (table)	The potential volume of wastewater and contaminants from exfiltration is expected to be minor compared to the current septic tank discharges. However, the potential environmental risks of exfiltration from each collection system alternative will be evaluated in the EIR.
	We hope that these comments are helpful in evaluating the issues discussed. Respectfully, (signature) Michael Saunders Compliance Program Manager Engineered Systems Division **Orenco Systems Inc.** **814 Airway Avenue** **Sutherlin, OR. 97479** *Ph: (541) 459-4449 ext. 443* *Fax: (541) 459-2884* ***www.orenco.com*** ***www.vericomm.net***	

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May 5, 2008

John Waddell
San Luis Obispo County Dept. of Public Works
County Government Center, Room 207
San Luis Obispo CA. 93408

Subject: **TECHNICAL MEMORANDUM FOR FLOWS AND LOADS**

Dear Mr. Waddell:

Orenco Systems, Inc. has reviewed the Draft Technical Memorandum for Flows and Loads dated February 2008. We offer the following comments and/or concerns for consideration:

I. Following is a direct quote from section 3.1 of the Flow and Loadings Tech Memo:

> "Gravity sewers utilize bell and spigot joint construction. Properly installed bell-and-spigot sewers will be watertight at first, and then may slowly lose their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints."

Comment:

We believe that the Fine Screening Analysis eliminates a bell and spigot joint gravity sewer technology as a viable option. The Fine Screening Analysis (page 1-6) states that a "viable project" could not result in an increase in the groundwater balance deficit, maintaining the existing basin balance (i.e. level 1) was considered the minimum viable project."

In support of our belief, we offer the following observations:

- The sentence containing the statement, "compromising their seals at the joints," depicts groundwater as the source for I/I.

- The Fine Screening states that the **newly constructed** gravity collection system can expect 300,000 gallons per day of wet weather infiltration and inflow (Table 1.2 page 1-10). This number represents a minimum I/I volume acceptable for new construction standards, and does not account for settling and aging resulting in additional infiltration and inflow. Additionally, this number would not include dry weather infiltration that would be associated with the miles of submerged gravity sewer pipe.

- In essence over the life cycle of the system, I/I ***risk*** is very high and will never get better only worse.

- Over the systems life cycle, the gravity sewer collection system will pump an un-quantified number of acre feet per year of groundwater out of Los Osos' shallow aquifer that will ultimately be run through the treatment plant. Within the context of the Fine Screening this is defined as a groundwater balance deficit.

This brings to light four significant points:

- The Carollo Engineering proposed gravity sewer system results in an increase in the groundwater balance deficit; therefore it does not meet the criterion used in the Fine Screening analysis to be a "viable project."

- The gravity sewer groundwater balance deficit is un-accounted for in the sea water mitigation study both in magnitude and in cost.

- It appears that fusion-welded PVC is the only solution that will make gravity sewer a "viable project." This cost is un-accounted for.

- The long-term ***risk,*** or potential magnitude of I&I is not quantified in any way. Given the goals and objectives for this project, it is inevitable that Los Osos will eventually be looking at methods for mitigating the impacts of I&I in the Los Osos water basin.

II. Following is a quote from section 6.0 of the Flow and Loadings Tech Memo:

"Inflow/infiltration (I/I) estimates for the collection system alternatives were the main source of uncertainty in calculating the future treatment facility influent flow volume. If a gravity collection system is selected, only a system that was constructed of fusion-welded PVC piping could be operated with as little I/I as the other types systems. However, fusion welded PVC sewers are a fairly new technology with little long-term operating history, and can be significantly more costly to install than traditional bell-and-spigot gravity sewers."

Comment:

This quote illustrates a double standard when comparing technology options. While every effort was made to establish costs for "high-end" quality STEP system, the cost of fusion welded PVC gravity sewer was not discussed nor quantified in any way. When the range of potential costs for STEP and gravity sewer were overlapped, the "high-end" potential costs for STEP appeared to be utilized in an effort to minimize the capital cost differential between it and a "low-end" gravity system cost. Had costs for a "high-end" gravity sewer system been quantified, the differential in costs would have been much more discernible.

The "high-end" STEP System cost includes every single cost that could possibly become applicable without any discussion on how unlikely or

how practical these costs would be. There was no effort to dismiss any material selection or construction technique on the premise that it would be "significantly more costly".

We promote the construction of water-tight STEP systems despite the fact that lower cost leaking tanks could produce a lower cost system. In fact, we could promote the use of the existing septic tanks if our sole goal was to provide the lowest cost STEP system. At no time have we promoted, nor have we even considered, compromising the quality of our STEP systems because it was too costly.

Similarly, we believe that a gravity sewer system can be designed and constructed with the intent of mitigating I/I to the fullest extent possible. These costs should be determined, quantified and compared so that we are truly doing an apples-to-apples comparison of technologies.

III. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:

"However, a treatment plant should be designed to accommodate a reasonably conservative level of inflow and infiltration (I/I)."

Comment:
To further complicate the gravity sewer collection challenges, the final Fine Screening did not reflect the true cost impacts of sea/ground water infiltration into the gravity sewer line, which can adversely impact beneficial reuse, sea water intrusion mitigation, and crop irrigation.

- Sea water contains approximately 35,000 mg/L Total Dissolved Solids including approximately 18,000 mg/L of Chlorides. It is documented that nitrifying and denitrifying bacteria are inhibited with increasing concentrations of chlorides. (See attachment, EPA Guidance Manual for Preventing Interference at POTW's, Table 2-1.) A high tide during low flow conditions could easily produce conditions toxic to both nitrifiers and de-nitrifiers.

- High chloride effluent would also limit the beneficial reuse of treated effluent for crop irrigation. (Asano, T., F. L. Burton, H. Leverenz, R. Tsuchihashi, and G. Tchobanoglous (2007) *Water Reuse: Issues, Technologies, and Applications*, *McGraw-Hill, New York.*)

- It is highly likely that in order to reuse the high chloride/total dissolved solids gravity sewer effluent beneficially; Reverse Osmosis would be needed, to remove the chloride and other constituents of concern. This cost is un-accounted for.

- A rough cost example is provided using the Wisconsin Dept. of Natural Resources rough estimate worksheet. Chloride removal technology could cost an additional $1,575,000 in capital costs and $511,000/year in O&M. (See attachments, Wisconsin Dept. of Natural Resources, Chloride Variance Information and Worksheet)

- The Fine Screening does not quantify the possible gravity sewer exfiltration of raw untreated wastewater contain into Los Osos' sensitive receiving environment.

IV. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:

> The Fine Screening Report recommended an I/I allowance of 0.3 mgd additional flow for the average monthly wet weather flow. This value was derived from an average infiltration allowance of 530 gpd/acre, (with a service area of 595 acres), which is appropriate for sewer systems with precast manholes and rubber-gasketed joints (Metcalf and Eddy, 1981).

Comment:
The recommended allowance of 0.3 mgd represents the allowable leakage for newly installed gravity sewer pipe. Essentially, it is the allowable leakage when testing *newly* installed gravity sewer for construction acceptance. This leakage does not include inflow, leakage into manholes nor I&I from on-site laterals. We would contend that this number does not necessarily define I&I nor does it quantify the potential *risk* of I&I increasing relative to the age of the systems.

VII. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:

> However, communities with excessive I/I often are those with sewer systems dating from an era before modern sewer construction techniques and materials. Page 6

Comment:
The example of the City of Lathrop, CA. dispels the myth that modern construction techniques and materials have less I&I.

The City of Lathrop, California is an example of a relatively **new PVC gravity sewer** system that is experiencing extensive I&I. Below, the lower graphic shows the increase in flow for the San Joaquin River that is attributable to a rain event. In the graphic that shows wastewater and water flow, the correlation between the wastewater flow and a rain event (documented in the river flow) is clearly evident. It should also be noted that the wastewater flow increase was independent of the water consumption. The impact of I&I is now causing impacts in treatment and capacity that will be costly to the Utility rate payers of that City

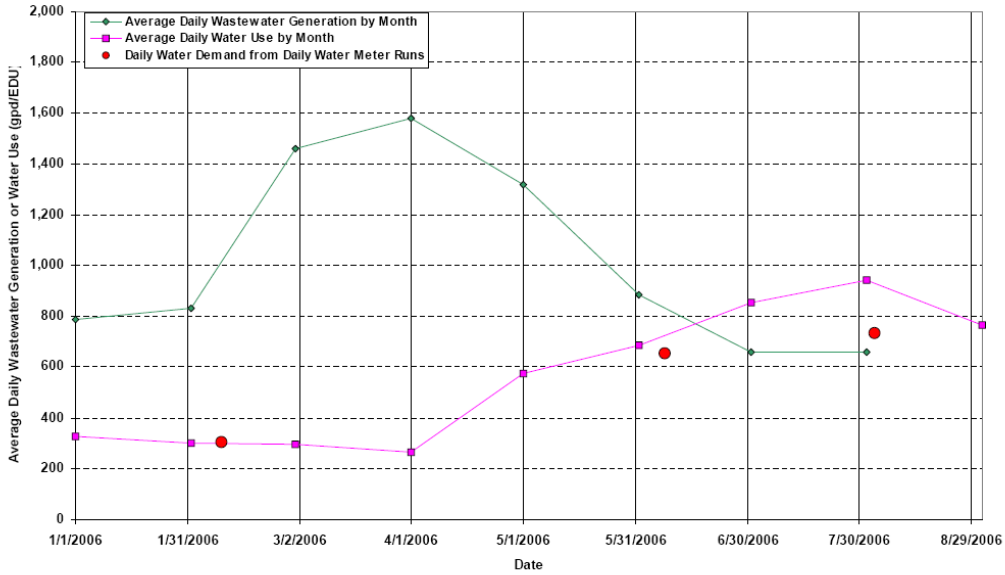
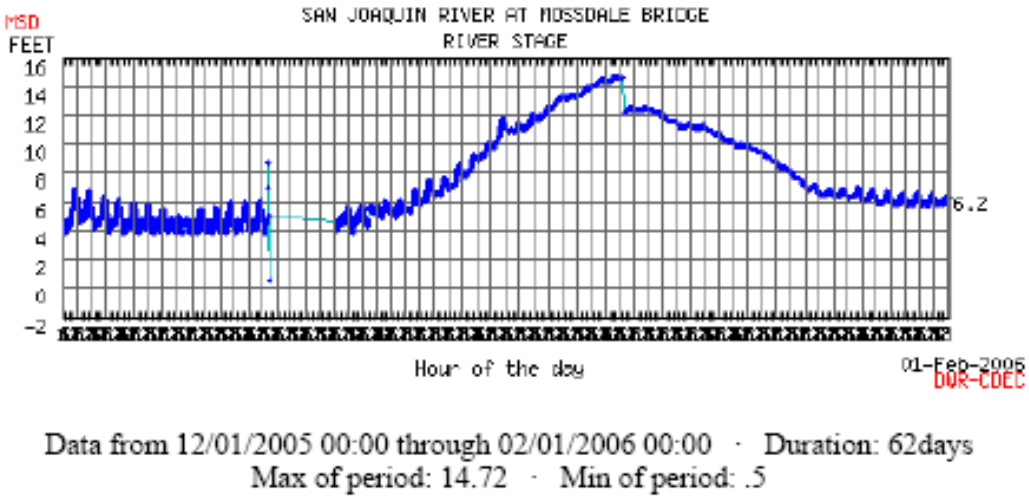


Figure 4
Average Daily Water and Wastewater Rates Per EDU Per Month – Basin 4



VIII. Following is a quote from section 3.1 of the Flow and Loadings Tech Memo:

> Table 4 shows a range of infiltration factors developed by various textbooks and other references. These represent I/I rates of older sewer systems. The I/I expected in a brand new system would be an order of magnitude lower than these values, and increase to these levels over a period of decades. The gravity sewer infiltration allowance used in this TM is greater than most of the rates suggested in these other references. It is therefore a conservative estimate. **The ADWWF expected for the wastewater treatment plant with a gravity collection system is 1.4 mgd** (1.1 mgd ADDWF, plus 0.3 mgd average I/I).

Table 4	Gravity Sewer Average Infiltration References Los Osos Wastewater Project Development San Luis Obispo	
Source	**Recommendation[1]**	**Corresponding Infiltration for Los Osos**
"Recommended Standards for Wastewater Facilities," Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers, 1997.	200 gpd/in-mi	77,000 gpd (0.077 mgd)
"Gravity Sanitary Sewer Design and Construction," American Society of Civil Engineers , 1982	500 gpd/in-mi[2]	190,000 gpd (0.190 mgd)
"Wastewater Engineering; Collection and Pumping of Wastewater," Metcalf & Eddy, 1981.	530 gpd/acre[3]	318,000 gpd (0.318 mgd)
"Civil Engineering Reference Manual", Michael R. Lindeburg, 2001.	200 gpd/in-mi or 10% of average flow	77,000 gpd (0.077mgd) or 120,000 gpd (0.120 mgd)
Infiltration Allowance for Viable Project Alternatives in Fine Screening Report (Gravity)	**780 gpd/in-mi**	**300,000 gpd (0.30 mgd)**

Notes:
(1) Total of sewer = 254,000 linear feet; 8 in diameter (gravity sewer average).
(2) Predominant value reported - many communities had much less.
(3) Los Osos service area = 595 acres

Comment:

The table, generated from Text Books, is clearly intended to provide validity to the I&I estimate that was utilized. Furthermore, the table would appear to assure the reader of this memorandum that the I&I estimates are far more conservative than they probably need to be. Unfortunately these values for I&I are not necessarily quantifications of gravity sewer I/I. These volumes generally represent the allowable leakage when testing *newly* installed gravity sewer for construction acceptance. Pipe leakage is a small portion of the overall I&I. I&I also includes leakage into manholes, inflow into manholes and I&I on private property. Additionally, I&I is affected by material specification, construction standards, construction quality. Also, I&I will assuredly increase relative to the system age.

If we review text books for the true definition of I&I, we will find that long term I&I is highly variable and that the possible ranges for long term I&I are somewhat startling. The referenced source for the definition of I&I, "Wastewater Engineering, Treatment and Reuse", Metcalf & Eddy, 2003, states that "the amount of water that can enter collection systems from groundwater, or infiltration, may range from 100

to 10,000 gal/d·in-mi or more". It also goes on to state that in terms of service area the range can be 20 to 3000 gal/ac·d on average and can be as high as 50,000 gal/ac·d during heavy rains. The same book also states that collection systems exhibiting infiltration also may exhibit exfiltration.

The I&I expectation should not be a referenced value from Metcalf & Eddy as has been presented, without a serious discussion regarding the potential impacts of I&I at higher than expected levels. While the quantity of 530 gpd/acre *may* be an appropriate approximation of I&I, given the goals and objectives of this project, it is very important to discuss the potential *risk* associated with I&I in a bell & spigot gravity sewer system.

The discussion of risks associated with I&I should include the potential for spills, sewer back-ups, changes in wastewater quality as well as the possible costs for fixes should excessive I&I occur.

IX. Following is a quote from section 3.2 of the Flow and Loadings Tech Memo:

With new septic tanks where drains and runoff are diverted away from the area around the tank, the I/I presumably would be much lower than that estimated for a gravity collection system. The major source of I/I in a STEP sewer is the tank and the connection to the house. I/I into the tank will be retained there and will not immediately translate into peak flows to the treatment plant. Based on these factors, average I/I is estimated to be 0.1 mgd.

Comment:
Onlot I/I in a STEP system can be detected early and corrected prior to any warranties etc. running out. Watertight structurally sound tanks with watertight connections that are tested in place during construction is a necessary standard. Web based monitoring controls can detect any compromise to this watertight standard. The same is not true for gravity sewer laterals to the home.

For comparison, all technologies must meet the same "watertight" standard, and for each there is a cost associated with that standard. For gravity sewer it's the cost of fusion welded PVC pipe, for low pressure grinder systems it's the cost of fiberglass pump basins, for STEP systems it's the cost of watertight/structurally sound STEP tanks.

X. Following is a quote from section 3.3 of the Flow and Loadings Tech Memo:

A low pressure sewer would have many of the same characteristics as a STEP sewer, except that some of the lines would have a smaller diameter in some places due to the need for the wastewater to obtain cleaning velocities. Additionally, in a low pressure sewer, homes would have a small grinder tank rather than a large septic tank, which would

presumably be less susceptible to inflow. However, these smaller tanks also have less capacity to equalize flow compared to STEP tanks. Therefore, the average I/I for low pressure sewers is estimated equivalent to a STEP sewer, which is 0.1 mgd with a peak I/I of 0.16 mgd. The PHWWF expected for a low pressure sewer is 1.8 mgd; **therefore the PHWWF for a low pressure sewer is expected to be 1.9 mgd.**

Comment:
The average I/I for STEP and low pressure sewer will only be equivalent if materials of construction for low pressure sewer are structurally sound and watertight. A very prominent grinder pump manufacture is being sued by a county in Michigan over poor quality, leaking grinder pump chambers.

While we agree that STEP tanks will reduce peak flows when compared to a grinder pump tank, we do not concur on the assumption that I&I will be lower. I&I at the tank is more a function of tank quality than tank size. Orenco specifies and assures that a tank will be watertight. Tanks are generally molded fiberglass or may be concrete if constructed to strict standards provided by Orenco. Orenco's strict policies regarding water-tight ranks, does not necessarily reflect on all manufactures of STEP and grinder pump systems.

Many grinder pump tanks are manufactured from either HDPE or fiberglass. Typically, the HDPE tanks are marketed at a much lower cost than the fiberglass pump tanks. The HDPE tanks have a tendency to flex under certain stresses. The flexure within HDPE tanks has been documented to cause leakage at pipe intrusions and at hatch openings.

When comparing Fiberglass tanks it is very important to compare the quality of the fiberglass construction. Orenco utilizes a patented molding process to build fiberglass tanks that will assure consistent wall thickness and consistent fiberglass composition. Inferior fiberglass construction can often result in pump tanks that are susceptible to structural failure, delamination or wicking.

XI. Following is a quote from section 4.0 of the Flow and Loadings Tech Memo:

The EPA (Amick, 2000) reports that exfiltration rates in leaking sewers are related to the relative depths of the sewer lines to the groundwater table, with greater depth to groundwater leading to higher rates of exfiltration. The groundwater table in Los Osos is high (less than 5 feet deep in some areas), so exfiltration is expected to be limited.

Comment:
The Infiltration and Exfiltration comments contained in this memo are contradictory. If as this quote suggests, exfiltration is limited because of high groundwater depth, then are the lines submerged? It is true that groundwater hydrostatic pressure will mitigate exfiltration, it will also exacerbate infiltration. Either the lines are

submerged or they are not, an exception maybe pipes installed under the tidal influence that will produce both conditions.

Below is a quote taken from the conclusion of the same EPA (Amick, 2000) report:

> Areas with significant portions of the system above, but in close proximity to, the groundwater table are probably at greatest risk. There is an increased risk in the relatively few areas with significant exfiltration potential when there is, for example, a thin soil and fractured rock hydro geologic setting which allows pathogens and other contaminants from the sewage to reach the ground water quickly and with minimal attenuation. Page 25.

In the context of the Los Osos project Amick details the ***RISK*** to ground water quality when a leaky technology is specified.

The June 2006 LOCSD report entitled "Los Osos Upper Aquifer Water Quality Characterization included the following table regarding the characterization of the 5 test wells that were utilized in the study"

Table 1
Upper Aquifer Sampling Locations

Well ID	Location	Well Depth	Perforated Interval	Depth to Water[1]
		Depths in feet below top of casing		
30S/10E-13F1	Solano/Butte	195	90-195	15
30S/10E-13Q1	Woodland/Doris	105	95-105	83
30S/11E-7Q1	8th Street/El Moro	75	29-43, 54-75	3
30S/11E-17E9	South Bay/Nipomo	204	184-194	82
30S/11E-18F1	Ferrell/7th	280[2]	183-231	95

Notes: [1]Measured on day of sampling , April 6, 2006 for all wells except 18F1 which was sampled on May 8, 2006.
[2]18F1 well depth originally 346 feet. Lower set of perforations sealed off prior to sampling.

Please note that 3 out of 5 wells clearly show water depths that are below the depth of a gravity sewer system. This study was done by Cleath & Associates, who was also the sub consultant for the Fine Screening Analysis that was done by Carollo Engineering.

The Fine Screening Analysis stated that the true value of I&I would "probably be much lower due to the sandy soils in the region that tend to direct water past the trench". More appropriately, it would appear reasonable to state that areas with high water tables have less risk of exfiltration but ***are at high risk*** for excessive groundwater infiltration. Conversely, it appears that there are areas with deep water tables and sandy soils that appear at risk for impact from exfiltration. The Memorandum and the Fine Screening analysis appear to lose credibility through contradictory findings.

XI. Following is a quote from section 4.0 of the Flow and Loadings Tech Memo:

In the case of exfiltration, the wastewater entering the groundwater would be higher in BOD and solids in a gravity or low pressure sewer compared with a STEP sewer. However, in Los Osos the major concern for groundwater quality is nitrogen. Wastewater flows from each type of sewer would have approximately the same concentration of nitrogen.

Comment:

Nitrogen has been a focal point for the groundwater quality because potable use of the shallow aquifer currently requires treatment to reduce nitrogen and/or the blending of water from deeper aquifers with the intent of diluting the nitrogen concentration The risk of discharging wastewater with high BOD, TSS, oils and greases and possibly chemicals or pathogenic organisms should not be dismissed without consideration as any and all of these constituents will be detrimental to groundwater quality. Also, the discharge of these elements into the shallow aquifer can also necessitate additional treatment or blending. Furthermore, at its worse, the threat of chemical contamination could compromise the use of the shallow aquifer for potable water altogether.

As an example, Modesto Groundwater Pollution is listed on the EPA Superfund Site with groundwater pollution caused by PCE exfiltration. The PCE originates from a Dry Cleaner discharging to a leaky gravity sewer. The information, as contained on the EPA web site follows:

Information from GAO Superfund Survey 1999

[California] MODESTO GROUND WATER CONT (CAD981997752)

Site ID: CAD981997752

Site name and region	Location, county, and size of site	Date EPA added site to National Priorities List (NPL)	When added to NPL, buildings present at site	When added to NPL, site also had	Primary contaminants at site	Causes of contamination	Public health advisory issued	Primary financial responsibility for site
Modesto groundwater contamination Region=9	Near Modesto, Modesto CA 95351 / Stanislaus / size not reported	Mar. 1989	commercial buildings (in use)		PCE	leaking sewer system	No	EPA

EPA's site ID=CAD981997752

Start date(s) for any planned or in-progress studies to determine best cleanup methods	Projected signing date(s) for any unsigned record(s) of decision (ROD) specifying cleanup actions to be performed
Not applicable	Not applicable

EPA's site ID=CAD981997752

We hope that these comments are helpful in evaluating the issues discussed.

Respectfully,

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