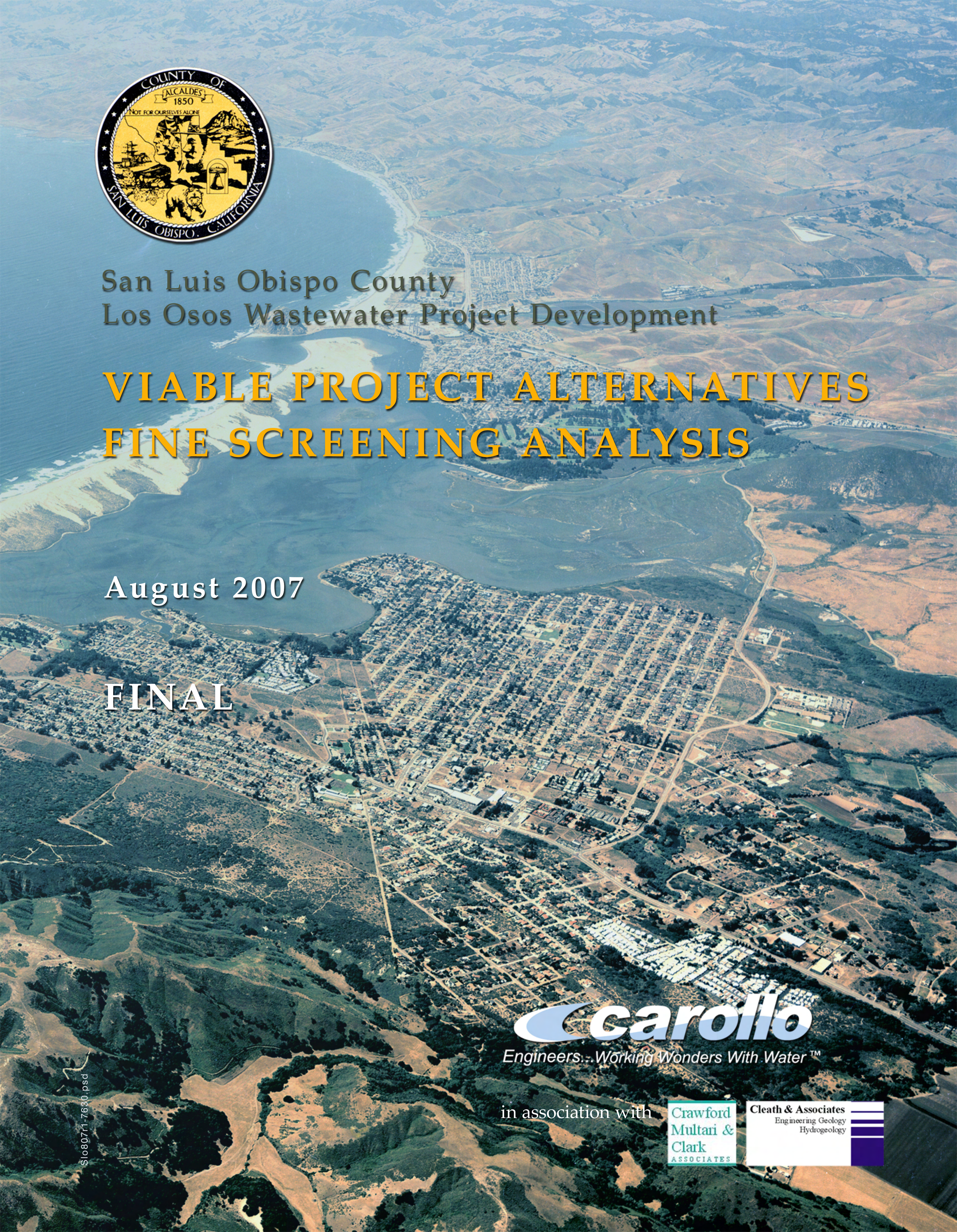

COUNTY OF SAN LUIS OBISPO, CALIFORNIA
ALCALDES 1850
NOT FOR OURSELVES ALONE

San Luis Obispo County
Los Osos Wastewater Project Development

# VIABLE PROJECT ALTERNATIVES FINE SCREENING ANALYSIS

August 2007

FINAL

carollo
Engineers...Working Wonders With Water™

in association with Crawford Multari & Clark Associates
Cleath & Associates
Engineering Geology
Hydrogeology

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San Luis Obispo County
Los Osos Wastewater Project Development

# VIABLE PROJECT ALTERNATIVES

# FINE SCREENING ANALYSIS

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**VIABLE PROJECT ALTERNATIVES**

**FINE SCREENING ANALYSIS**

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# EXECUTIVE SUMMARY

## INTRODUCTION AND OVERALL APPROACH

The purpose of this Viable Project Alternatives (VPAs) Fine Screening Report is to further develop “community options” that the County believes it could implement for Los Osos. Consistent with the “Rough Screening” report prepared by the County’s Project Team and published in March 2007, this report continues to screen project components that previously passed through rough screening and to assemble them into VPAs, or community options. The Tri-W Project is also discussed in this report, although the focus has been to provide alternatives to the Tri-W Project. This report will be utilized, among other things, as the basis for the project Technical Advisory Committee’s pro/con analysis of community options and for the Assessment Engineer and the County to identify “special benefits” of a community wastewater project, which is a required step for the forthcoming Proposition 218 ballot.

There are numerous issues associated with the Los Osos wastewater project. This report and screening process is one of many ongoing efforts that are part the County process to develop a wastewater project. The development of community options is an important effort because it is intended to identify those projects that could be implemented by the County for Los Osos, without relying on importing water resources, or relying on other communities for wastewater treatment and disposal.

Since the County’s Proposition 218 process will be a funding decision and not a project selection decision, it is important to recognize that the community options identified in this report do not fully reflect all of the detailed alternatives that could be developed and implemented by the County. The report, nevertheless, provides information on what the community can expect through a County implemented solution, in terms of costs, benefits and overall approach. Further details such as regional options will be identified in a full environmental review prepared in accordance with the California Environmental Quality Act (CEQA) and/or the National Environmental Policy Act (NEPA).

Ultimately, the County’s project selection process will include a community-wide survey, workshops, and other community participation efforts so that final project decisions meet the needs and desires of the community to the greatest extent possible. In accordance with State and Federal laws, those additional work efforts and final project selection decisions will be completed concurrently with the environmental review efforts.

## RELATIONSHIP TO WATER RESOURCE MANAGEMENT

An important aspect of evaluating wastewater options included considering water resources issues. In Los Osos, water resource issues become even more important as a result of the seawater intrusion that is contaminating the Los Osos groundwater basin. On March 27, 2007, the San Luis Obispo County Board of Supervisors certified a “Level of Severity (LOS)” III for the community of Los Osos while adopting a Resource Capacity Study for the Los Osos groundwater basin. The LOS III determination is the highest determination of a resource problem under the County’s Resource Management System (RMS).

The wastewater project can be an important first step to solving water resource problems. The community options included in this report do not tie or bind a specific wastewater solution with a specific water resource solution (i.e., they do not require “how” water resources must be solved). Instead, the options illustrate how different approaches to water resource solutions can be achieved through the different approaches to a wastewater project.

In this report, approaches to water resource solutions are identified as part of the wastewater disposal and reuse alternatives. The disposal and reuse options are combined into projects representing several levels of seawater intrusion mitigation since seawater intrusion is the single best benchmark that quantifies the water resource problem. The latest estimates of seawater intrusion indicate that 460 acre-feet (149 million gallons) of salt water migrates into the fresh groundwater basin underlying Los Osos each year.

Table ES.1 shows the defined levels of mitigation used in this report. These levels represent the main benefits of the wastewater project beyond addressing the Regional Water Quality Control Board Waste Discharge Requirement. For the purposes of this report, it was assumed that a viable project must not worsen the existing seawater intrusion problem. Therefore, all VPAs have a minimum seawater intrusion mitigation of Level 1 or higher. Mitigation of seawater intrusion to the higher levels (Levels 3 and 4) will require the cooperation of the water purveyors.

In addition to technical issues that relate the wastewater challenges with water resource problems, the County’s approach provides a basis to distinguish how cost sharing should be developed between the wastewater project, and how and who pays those costs, and the water resource benefits, and how and who should pay those costs. Some of the water resource issues are currently being litigated, and since the full extent of these issues cannot be covered in this report as a result of the normal and confidential handling of litigation, it should nevertheless be noted that the County has expressed its hope of developing solutions to water resource in a cooperative manner with the water purveying organizations of Los Osos.

| **Table ES.1** | **Levels of Seawater Intrusion Mitigation (Project Benefits)[1]<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** | | | |
|---|---|---|---|---|
| **Level** | **Absolute Volume Mitigated (AFY)[2]** | **Project Impact, Relative to Current Conditions (AFY)** | **Overall Basin Balance (at Current Pumping Rates) (AFY)** | **Description** |
| Level 0 | 0 | -90 | -550 | No mitigation of seawater intrusion |
| Level 1 | 90 to 140 | 0 to 50 | -460 to -410 | Mitigation of seawater intrusion similar to current conditions |
| Level 2 | 190 to 240 | 100 to 150 | -360 to -310 | Maximum mitigation of seawater intrusion possible without purveyor participation |
| Level 3 | 550 to 600 | 460 to 510 | 0 to 50 | Achievement of a balanced basin at present water use rates |
| Level 4[3] | 780 to 830 | 690 to 740 | 230 to 280 | Achievement of a balanced basin at buildout |

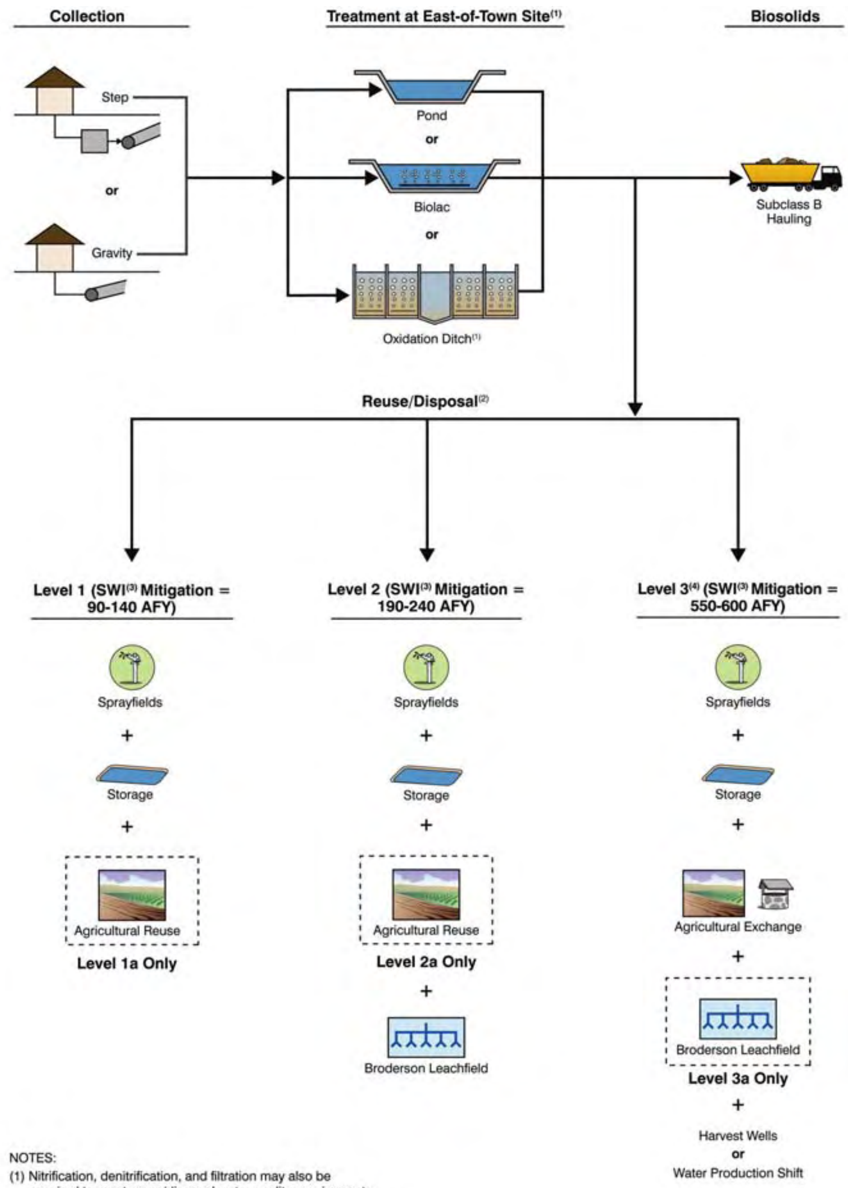
Notes:
(1) In addition to the benefits associated with complying with the WDR.
(2) One acre-foot/year (AFY) is equal to 892 gallons per day (GPD).
(3) Level 3 and level 4 are possible to achieve, but only with extensive infrastructure reconfiguration by the water purveyors.

## DEVELOPMENT OF VIABLE PROJECT ALTERNATIVES

Similar to the Rough Screening Report, the content of this Fine Screening Report includes evaluation of the different components of a wastewater project including reuse/disposal, collection system, wastewater treatment, biosolids treatment/disposal and facility siting.

Disposal and reuse alternatives were developed for meeting seawater intrusion mitigation at Levels 1 and 2 using various combinations of spray disposal, agricultural reuse, leachfields at Broderson and conservation. Implementation of a Level 3 project requires other groundwater management techniques to be implemented, which requires purveyor participation. Both Gravity and STEP/STEG collection are assumed to be viable for each alternative; however, effluent nitrogen levels may require additional treatment (nitrification and/or denitrification) for reuse/disposal alternatives requiring low nitrogen. Oxidation ditches, Biolac and partially mixed facultative ponds are all carried forward as viable treatment technologies. Sub-Class B solids treatment and hauling appears to be the low cost alternative and allows the community to develop composting/local recycling in the future. High priority sites were assumed to be viable for any of the alternatives and final selection should be based on considerations such as detailed geotechnical site evaluations, environmental compliance and land acquisition.

Combining the elements into viable project alternatives required understanding the dependency between the disposal/reuse, treatment and collection systems. The choice of a disposal/reuse alternative decides the level of treatment needed. In turn, the choice of the collection system affects the processes needed to meet the required level of treatment. For example, the use of a STEP/STEG collection system decreases the need for treatment due to lower total suspended solids and BOD. However, as the carbon the influent to the plant is greatly lowered with a STEP/STEG collection system, meeting low nitrogen limits (denitrification) requires the addition of a carbon source (methanol), which increases treatment costs. The viable project alternatives for the different levels of seawater intrusion mitigation are shown in Figure ES.1. The reuse/disposal combinations shown in Figure ES.1 represent the elements included in each VPA but not the quantities or size required for each VPA. Details on each VPA's reuse and disposal elements are discussed in Chapter 2.




NOTES:
(1) Nitrification, denitrification, and filtration may also be required to meet reuse/disposal water quality requirements.
(2) Although each of the reuse/disposal alternatives have many of the same components, the capacity of the components vary between projects.
(3) SWI = Sea Water Intrusion
(4) Level 3 can only be achieved with water purveyor participation which likely will extend the implementation time.

**Figure ES.1**
**VIABLE PROJECT CONFIGURATIONS**
LOS OSOS WASTEWATER TREATMENT
PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

The total construction cost and total project cost ranges for the VPAs are developed in Table ES.2 for all elements of the projects including the collection system reuse/disposal, and siting. For comparison purposes, the Tri-W Project is also shown in Table ES.2. The total project costs are also shown in Figure ES.2.

All of the cost estimates include an inflation factor to account for the estimated escalation of costs from February 2007 (basis of cost estimates in this Fine Screening Report) to the mid-point of construction, currently scheduled for June 2011. The estimated project inflation through June 2011 represents essentially a six-year inflation period since previous cost estimates and bids in 2005.

**Table ES.2 Viable Project Alternatives Range of Costs, Millions[(1)]**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Project Element | | Seawater Intrusion Mitigation Level 1 | | Seawater Intrusion Mitigation Level 2 | | Seawater Intrusion Mitigation Level 3 | | Tri-W Project |
|---|---|---|---|---|---|---|---|---|
| | | 90 AFY | 140 AFY | 190 AFY | 240 AFY | 550 AFY | 600 AFY | ~285 AFY |
| Collection System | STEP | $65 - 81 | $65 - 81 | $65 - 81 | $65 - 81 | $65 - 81 | $65 - 81 | $N/A |
| | Gravity[(7)] | $83 - 90 | $83 - 90 | $83 - 90 | $83 - 90 | $83 - 90 | $83 - 90 | $81 - 82 |
| Treatment (Liquid and Solids) [(2)] | STEP | $14 - 18 | $23 - 25 | $20 - 22 | $23 - 25 | $23 - 25 | $23 - 25 | N/A[(8)] |
| | Gravity | $15 - 22 | $23 - 26 | $20 - 22 | $23 - 26 | $23 - 26 | $23 - 26 | $55 |
| Disposal/Reuse | | $13 - 16 | $13 - 14 | $15 - 17 | $13 - 14 | $26 - 30 | $26 - 27 | $20 - 23 |
| Treatment Facility Site[(3)] | | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 |
| Permitting/Mitigation[(4)] | | $1 - 2 | $1 - 2 | $1 - 2 | $1 - 2 | $1 - 2 | $1- 2 | $1 - 2 |
| Total Construction Costs | STEP | $94-120 | $103 -126 | $102-125 | $103-126 | $116-142 | $116-139 | N/A |
| | Gravity | $113-132 | $121-135 | $120-134 | $122-135 | $135-151 | $134-148 | $158 - 165 |
| Total Construction Costs Escalated to Mid-Point of Construction[(5)] | STEP | $117-150 | $128-157 | $126-156 | $129-157 | $144-176 | $144-173 | N/A |
| | Gravity | $141-164 | $151-168 | $149-167 | $152-168 | $168-188 | $167-184 | $197 - 205 |
| Project Costs[(6)] | STEP | $18-24 | $18-24 | $18-24 | $18-24 | $21-26 | $21-26 | N/A |
| | Gravity | $16-21 | $16-21 | $16-21 | $16-21 | $19-23 | $19-23 | $12 - 17 |
| Total Project Costs[(5)] | STEP | $135-174 | $146-181 | $144-180 | $147-181 | $166-202 | $165-199 | N/A |
| | Gravity | $157-185 | $167-189 | $165-188 | $168-189 | $187-211 | $186-207 | $209 - 222 |

N/A - Not Available.
Notes:
(1) Estimated Construction Costs in April 2007 dollars including contractor overhead and profit and 30% design contingency (feasibility-level estimate).
(2) From Table 7.3 - shows combined costs of liquid treatment and solids treatment/disposal.
(3) Assumes approximately 40 acres acquired, except for Tri-W Project. Actual acreage may vary depending on the final site and plant configuration.
(4) Costs do not include land restoration costs at $20,000 to $50,000 per acre.
(5) Assumes mid-point of construction is June 2011. Escalation at 24.5% of construction cost sub-total per the Basis of Cost Evaluation (Carollo Engineers, May 2007).
(6) Project costs include design, construction management, administration and legal costs, as detailed in the Basis of Cost Memorandum in Appendix C.
(7) Cost do not include $13 to 25 million for electrical connection premium for separate electrical service that may be incurred if permitting and/or funding requirements stipulate this requirement and the funding is pursued.
(8) Tri-W costs based on gravity collection system. Treatment Costs for the Tri-W Project with STEP collection are not available from bid tab information. Based on other treatment process costs, MBR costs associated with STEP collection could be approximately 10 to 15% less than when associated with a gravity collection system.

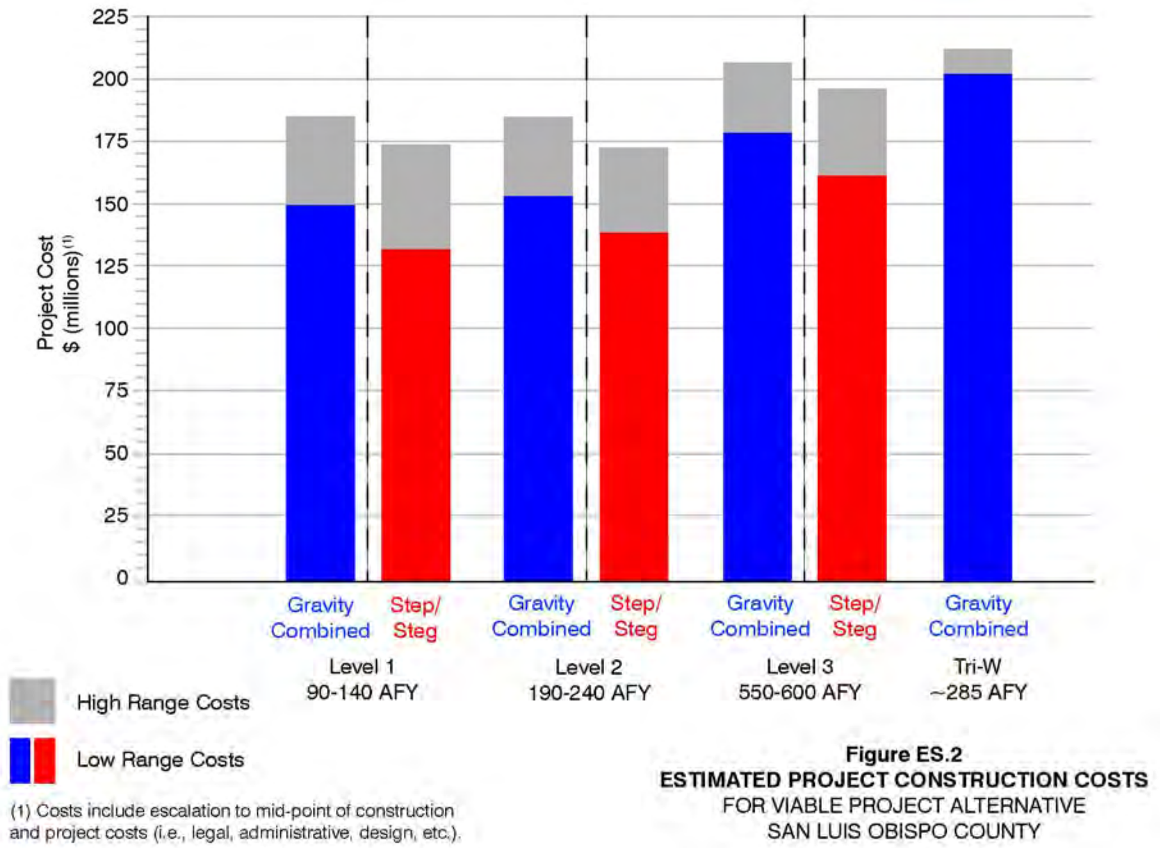
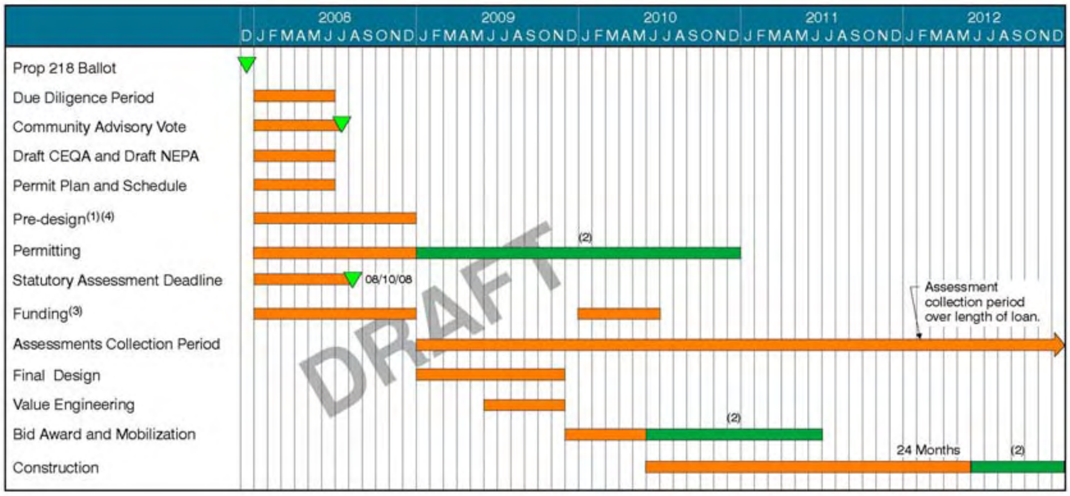



**Figure ES.2**
**ESTIMATED PROJECT CONSTRUCTION COSTS**
FOR VIABLE PROJECT ALTERNATIVE
SAN LUIS OBISPO COUNTY

Figure ES.3 shows a preliminary project schedule believed to be achievable for each of the community options. The schedule is aggressive and includes numerous assumptions that need to be confirmed including:

- Federal funding is available.
- Habitat Conservation Plan (HCP) requirements do not significantly impact the permitting time frame.
- Competitive bidding and public contracting efforts are optimized for the project, including options on funding through, for example, private markets.
- The Draft Environmental Impact Report (EIR) will be completed by mid-2008 at which point a preferred treatment facility site will be identified.




NOTES:

1. Early predesign effort to support EIR, permitting and funding including interactions with water purveyors.
2. Permitting could be as short as 12 months or as long as 36 months to complete.
   Bid, award and construction would **not** take place until premitting task is complete.
3. Funding may take place in more than one phase.
4. DOES NOT include potential litigation.

**Figure ES.3**
**DRAFT PROJECT SCHEDULE(4)**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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## NEXT STEPS

The County Board of Supervisors will consider the final report in August 2007 and the Assessment Engineer and the County will identify "special benefits" of the project that will be required for the forthcoming Proposition 218 ballot in late summer/fall 2007.

# INTRODUCTION

## 1.1 INTRODUCTION

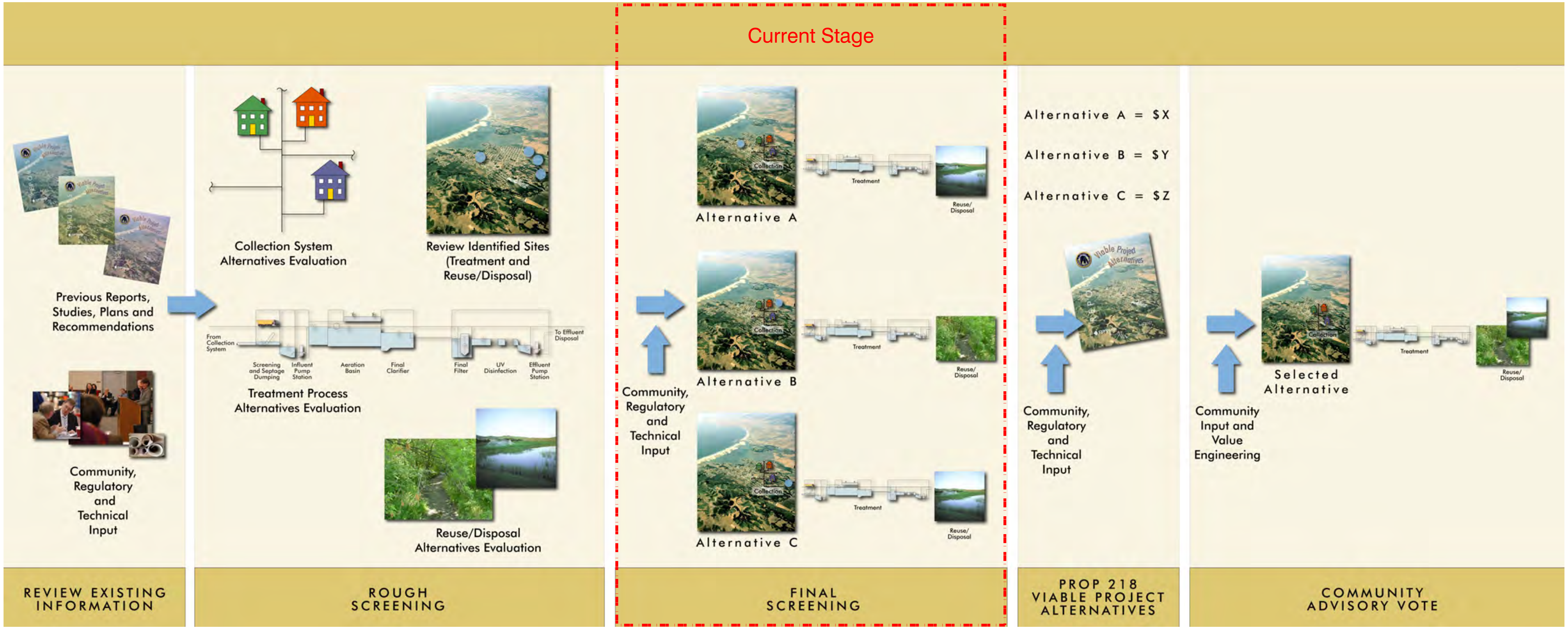
The purpose of the Viable Project Alternatives (VPAs) Fine Screening Report is to further develop “community options” that the County of San Luis Obispo believes it could implement for Los Osos. Consistent with the “Rough Screening” report prepared by the County’s Project Team and published in March 2007, this report continues to screen project components that previously passed through rough screening and to assemble them into VPAs, or community options. This report will be utilized, among other things, as the basis for the project Technical Advisory Committee’s pro/con analysis of community options and for the Assessment Engineer and the County to identify “special benefits” of a community wastewater project, which is a required step for the forthcoming Proposition 218 ballot. An overview of the selection process and the current stage are illustrated in Figure 1.1.

Presented in this chapter are the background of the project, a brief summary of the Rough Screening Report, a description of the purpose of this Fine Screening Report, the assumptions for flow projections, and the basis for screening alternatives.

### 1.1.1 Background

The community of Los Osos, California is located on the coastline of Central California adjacent to the Morro Bay State and National Estuary. This area has no year round surface water source. Consequently, the community relies on the underlying groundwater for its drinking water. The community also relies primarily on privately owned septic tanks for wastewater treatment and disposal. As a result, the groundwater in the aquifer underlying the community has become contaminated with nitrate. In order to address this problem, the Regional Water Quality Control Board (RWQCB) is requiring a community wastewater collection and treatment project to be implemented, an effort that is currently being led by the County of San Luis Obispo under the authority of Assembly Bill 2701 (Blakeslee) which was approved by unanimous vote of the California State Legislature, on a combined vote of 111 to 0, and signed by Governor Schwarzenegger on September 20, 2006. This report provides a fine screening of the project components and development of VPAs for that anticipated project.

Numerous issues exist that are associated with the Los Osos wastewater project. This report and screening process utilized for the County of San Luis Obispo is one of many ongoing efforts under the County process. The development of community options is an important effort because it is intended to identify those options that could be implemented by the County for Los Osos, without relying on importing water resources, or connecting to other communities for wastewater service.




The County has identified a 5-step process to select a viable project alternative.
This figure illustrates the current stage of the project, which is the fine screening.

**Figure 1.1**
**VIABLE PROJECT ALTERNATIVE DEVELOPMENT**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

### 1.1.2 Summary of Rough Screening Report

The "Potential Viable Project Alternatives Rough Screening Report" (Carollo Engineers, March 2007) for the Los Osos Wastewater Project Development was released in March 2007. The Rough Screening Report was the first step in the analysis of VPAs. It described the overall results of reviewing prior project reports and identified those project technologies (or "components") to be studied in further detail in this report for the purpose of identifying community options for a wastewater project.

A wide array of potential project components was examined for effluent reuse/disposal, treatment technology, solids treatment and disposal, treatment facility siting and the collection system. The basis of evaluation for the rough screening of the project components listed above included:

- Fatal Flaw Analysis - An alternative was removed from consideration if it had a characteristic that clearly impeded its implementation, either from a cost, regulatory, institutional, or technical standpoint.
- Elimination of Redundancy - An alternative was removed from consideration if it was equivalent to the alternative that had already been developed for the Tri-W project.
- Removal of Equivalent Components - A project component was removed from consideration if there is an alternative component that was clearly superior in one respect, even if it was otherwise comparable.

Table 1.1 shows the project component alternatives that passed through rough screening for consideration in this Fine Screening Report. The interdependent nature of treatment technology, treatment plant sites, and disposal options, versus the independent nature of collection system alternatives and biosolids disposal methods was noted in the Rough Screening Report. (While it was recognized that the collection system selection will have some impact on the treatment plant facilities, its selection was considered independent of the treatment technology, which will be driven primarily by reuse/disposal options.)

An introduction to groundwater management was also incorporated into the Rough Screening Report to provide information on the main challenges facing the community water supply and to introduce water balance concepts that were used during fine screening.

## 1.2 PURPOSE OF FINE SCREENING REPORT

During the fine screening phase of work, the potentially viable project component alternatives were compared and screened down to a final list of potential project components to be carried forward and combined into a short list of VPAs that are believed to be permitable, constructible and fundable.

**Table 1.1 Potentially Viable Project Components that Passed Rough Screening**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Potential Treatment Process | Potential Reuse/Disposal Alternatives | Potential Siting Alternatives | Potential Solids Disposal Alternatives | Potential Collection System Alternatives |
|---|---|---|---|---|
| • Membrane Bio-Reactor (MBR)<br>• Extended Aeration<br>• Sequencing Batch Reactor (SBR)<br>• Oxidation Ditch<br>• Biolac® Extended Aeration<br>• Trickling Filter Solids Contact<br>• Partially Mixed Facultative Ponds | • Leach Fields<br>• Percolation<br>• Spray Fields<br>• Agricultural Reuse<br>• Urban Reuse<br>• Constructed Wetlands | • Tri-W<br>• Cemetery<br>• Giacomazzi<br>• Andre 2<br>• Morosin/FEA<br>• Branin<br>• Gorby (LOVE Farm)<br>• Robbins 1<br>• Robbins 2 | • Recycling of Digested/ Composted Class A Biosolids<br>• Recycling of Composted Class A Biosolids<br>• Hauling of Digested Class B Biosolids<br>• Hauling of Composted Class B Biosolids<br>• Hauling of Sub-Class B Dewatered Biosolids | • STEP/STEG<br>• Gravity/ Vacuum/ Low Pressure Combination |

The Fine Screening Report does not conclude with a recommended project, but rather identifies a short-list of VPAs that provide varying degrees of project benefit (as measured by sea water intrusion mitigation) and costs. The short list of VPAs will be used by the project Technical Advisory Committee for the pro/con analysis, and by the Assessment Engineer to determine the cost of the "special benefits" conferred by the project. The County's proposed assessments will be subject to Proposition 218 assessment proceedings and a property owner ballot process pursuant to Article XIIID of the California State Constitution. It is important to recognize that the community options identified in this report do not fully reflect all of the detailed alternatives that could be developed and implemented by the County. The details of the assessment engineering issues will be included in the Assessment Engineer's report and are only referred to in general terms in this Fine Screening Report. Nevertheless, the County-adopted policies and strategies from June 19, 2006 identify the intent for the Proposition 218 assessment proceedings to act as a funding decision, consistent with the "right to vote on taxes act."

The County's adopted strategies also express the intent to conduct additional evaluations and determinations that may be required under the California Environmental Quality Act (CEQA) after the Proposition 218 proceedings so that the Proposition 218 proceedings reflect a funding decision by the community and not a project technology and site selection decision.

For the purpose of this report, the minimum viable project was considered a project that included facilities required to support the primary goal of the wastewater project, which is to comply with the Waste Discharge Requirements (WDRs) that are imposed on the "Prohibition Zone" in the community by the RWQCB, without worsening the existing groundwater condition.

Beyond the minimum viable project, the project may include facilities that may or may not be part of the immediate wastewater project itself, that have been included at the community's discretion or as regulatory permit condition. Examples of additional facilities would be those included in the project to balance the groundwater basin, ensure a sustainable water supply, and/or other requirements established by permitting agencies.

### 1.2.1 Seawater Intrusion Mitigation

An important aspect of evaluating wastewater options in California today includes considering water resources issues. In Los Osos, water resource issues become even more important as a result of known and ongoing seawater intrusion that is contaminating the Los Osos groundwater basin. On March 27, 2007, the San Luis Obispo County Board of Supervisors certified a "Level of Severity" III for the community of Los Osos while adopting a Resource Capacity Study for the Los Osos groundwater basin. The LOS III determination is the highest determination of a resource problem under the County's Resource Management System (RMS).

Although recognizing the relationship between water resource problems and wastewater challenges is important, it was also important to recognize that a fundamental part of the development of VPAs was to address solving the WDR first and the community's water resources problems second. Under current basin management practices, seawater intrusion is occurring in the lower aquifer at a rate of 460 acre-feet per year due to excessive production, while groundwater in the upper aquifer is underutilized due to nitrate contamination. The Los Osos wastewater project will collect and redistribute a significant portion of the community's water resources. The community options included in this report do not tie or bind a specific wastewater solution with a specific water resource solution (i.e., they do not require "how" water resources must be solved). Instead, the options illustrate how different approaches to water resource solutions can be achieved through the different approaches to a wastewater project. The project provides an opportunity to begin the process of mitigating seawater intrusion, reducing nitrate contamination, and setting long-term goals for achieving a sustainable water supply.

#### 1.2.1.1 Levels of Mitigation

An approach to water resource solutions as an element of wastewater reuse/disposal alternatives is identified later in this report. The disposal and reuse options were combined into projects representing several levels of seawater intrusion mitigation since this was determined to be the single best benchmark to quantify the groundwater resource problem. These levels represent the primary water resource solutions (benefits) of the wastewater project.

- Level 0: No mitigation of seawater intrusion (i.e., an increase in seawater intrusion).
- Level 1: Seawater intrusion similar to current conditions.
- Level 2: Maximum mitigation of seawater intrusion without purveyor participation in project development.
- Level 3: Achievement of a balanced basin at present water use rates.
- Level 4: Achievement of a balanced basin at buildout.

Note that based on the criterion that any "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.

Each of these levels of mitigation can be achieved by progressively developed potential projects, each of which has its associated costs. In general, the cost of the project will increase with increasing seawater intrusion mitigation (i.e., the greater the mitigation addressed, the greater the project cost). This relationship is illustrated in Figure 1.2.

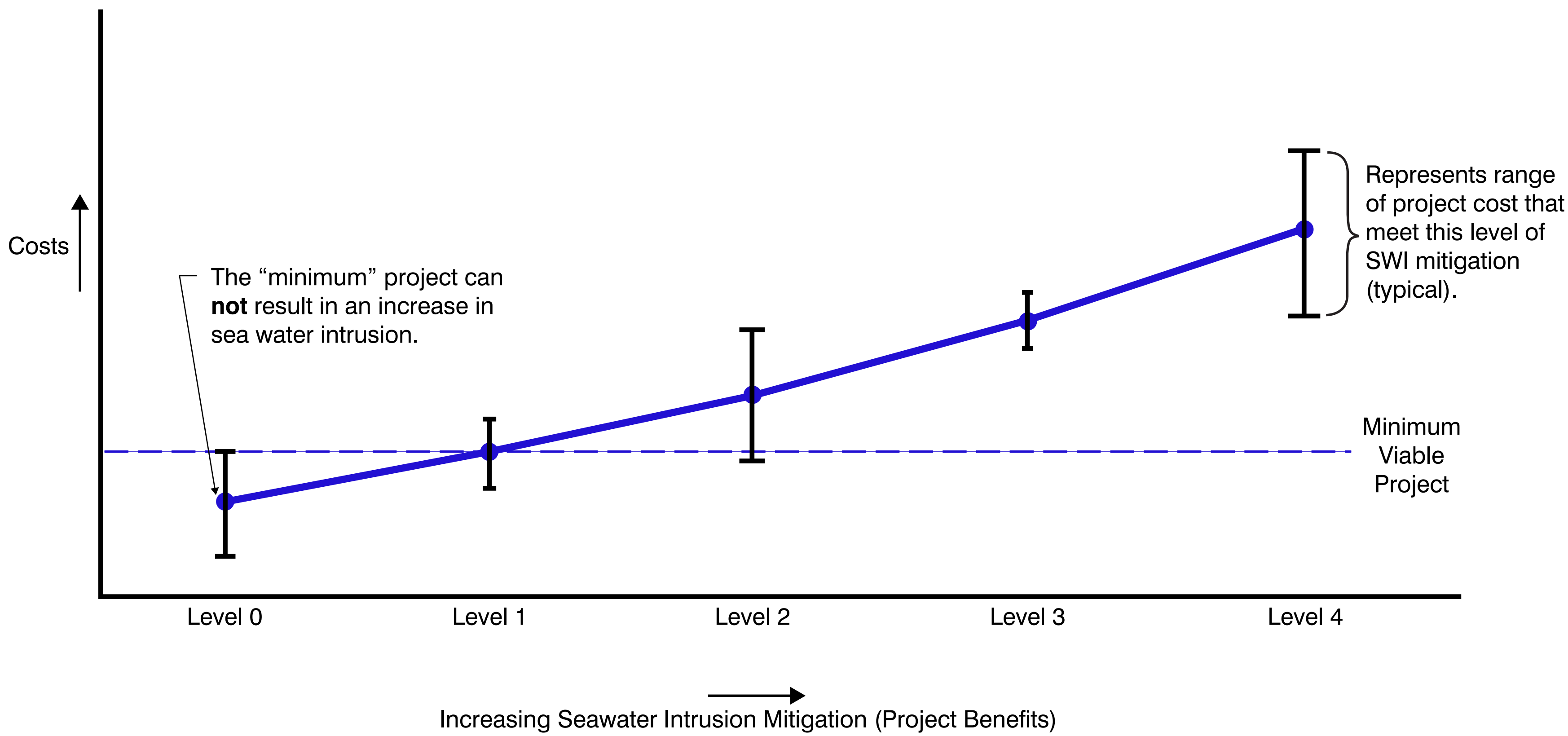



**Figure 1.2**
**POTENTIAL VIABLE PROJECT**
**ALTERNATIVE COST-BENEFIT CURVES (ILLUSTRATIVE)**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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### 1.2.2 Scope of Wastewater Project and Purveyors' Responsibility

Of the reuse/disposal alternatives under consideration, only the disposal options such as spray fields and leach fields are completely encompassed within the scope of this project. In general, the reuse options depend on the cooperation of reclaimed water users and/or the water purveyors, namely the LOCSD and the Golden State Water Company. For example, the alternatives that have the greatest effect on mitigation of seawater intrusion (level 3 and 4 mitigation) require the water purveyors to accept either highly treated harvest well water, or water that is currently being used for agricultural irrigation. Water introduced into their systems in either of these ways would enable the purveyors to reduce pumping of the lower aquifer, thus reducing seawater intrusion. A water conservation program implemented by the water purveyors is another strategy that would have a marked effect on seawater intrusion.

The County's approach to the wastewater project will eventually provide a basis to distinguish how cost sharing should be developed between the wastewater project (and how and who pays those costs), and the water resource benefits (and how and who should pay those costs). Some of the water resource issues are currently being litigated, and the full extent of these issues cannot be covered in this report as a result of the normal and confidential handling of litigation. It should nevertheless be noted that the County has expressed its hope of developing solutions to water resources in a cooperative manner with the water purveying organizations of Los Osos. The potential participation by the purveyors in the disposal/reuse alternatives is discussed further in Chapter 2.

### 1.2.3 Sustainability and Future Adaptability

While it is possible to design a project that meets the present needs of the community, it is a goal of the Los Osos community to consider the future of the project so as to minimize future expenditures and the possibility of stranded assets. For example, facilities should be designed so that future regulations requiring treatment upgrades or changes in biosolids handling rules can be easily accommodated. Similarly, a pipeline conveying treated effluent to a disposal site that can accommodate the full effluent flow at present levels but not at buildout may be less costly in the short term, but more costly in the long term if another pipeline has to be constructed in the future. VPAs will be configured to provide flexibility in meeting future needs of the community without "regret" to investments of current assets.

The VPAs will be selected with the consideration that sustainability is a stated goal for the community of Los Osos. The VPAs will contain options where wastewater will be disposed/reused as a resource to benefit the community. That said, the construction and operation of any wastewater project will consume energy, whereas Los Osos currently consumes no energy in treating its wastewater. However, due to the groundwater pollution resulting from the current situation, a wastewater project is necessary for the community.

The environmental and economic consequences of energy consumption will be given special consideration to develop projects where they are minimized. In Addition, options for individual homeowners to help mitigate the environmental and economic impact of the wastewater project include gray water systems, rain water catchment in existing septic tanks, water conserving landscape, and solar power to offset additional energy consumption.

## 1.3 FLOW PROJECTIONS

Estimates of the projected wastewater flows and loads were outlined in the Rough Screening Report. The load estimates have not changed, but the flows estimates have been further reviewed in this report due to increased estimates of Inflow/Infiltration. The estimate for the dry weather flow at buildout without conservation remains at 1.2 MGD.

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 STEP/STEG collection system is selected it is anticipated that there will be minimal I/I since the system is sealed and under pressure. 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 a STEP/STEG system. However, fusion welded PVC sewers are a new technology with little long-term operating history, and can be significantly more costly to install than traditional bell-and-spigot gravity sewers.

Properly installed bell-and-spigot sewers will be watertight at first, and then slowly lose their integrity as the surrounding soils shift, compressing the pipes, and compromising their seals at the joints. The water-tightness of a bell-and-spigot sewer can be preserved if a maintenance program is conducted on an ongoing basis to detect and repair leaks. This program would add to the cost of a gravity sewer compared to a STEP/STEG sewer with similar levels of I/I.

As discussed in the Rough Screening Report, previous studies used standard collection system textbook models[1] to estimate the I/I per mile per inch diameter of pipe of gravity sewer. The total predicted I/I of the system was divided by the estimated population in order to calculate the projected I/I per capita. During wet weather, a conservative estimate for a conventional system I/I of 17 gpcd was given, which corresponded to a total potential wet weather flow of 1.5 MGD for Los Osos. However, it was pointed out that the true value would probably be much lower due to the sandy soils in the region that tend to direct water past a pipe and trench, and due to the presumed water-tightness of a new collection system. Using the textbook models, Montgomery Watson Americas, Inc., anticipated that

[1] From *Wastewater Engineering, Collection and Pumping of Wastewater*, Metcalf and Eddy (1981), and *Gravity Sanitary Sewer Design and Construction,* American Society of Civil Engineers (1982).

7 gpcd would be a more realistic estimate of wet weather I/I, corresponding to a total wet weather flow of 1.3 MGD for Los Osos.

Table 1.2 shows a range of infiltration factors developed for various manufacturing references and textbooks. The gravity sewer infiltration allowance used in this Fine Screening Report is greater than most of the rates suggested in these other references, and is therefore a conservative assumption.

**Table 1.2 Gravity Sewer Infiltration References**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Source | Recommendation | 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 |
| "Installation Guide for PVC Sewer Pipe" PWPipe, March 2000. | 50 gpd/in-mi | 19,000 gpd |
| "Gravity Sanitary Sewer Design and Construction," American Society of Civil Engineers, 1982. | 500 gpd/in-mi | 190,000 gpd |
| "Wastewater Engineering; Collection and Pumping of Wastewater," Metcalf & Eddy, 1981. | 530 gpd/acre(3) | 318,000 |
| "Civil Engineering Reference Manual", Michael R. Lindeburg, 2001. | 200 gpd/in-mi<br>or<br>10% of average flow | 77,000 gpd<br>or<br>120,000 gpd |
| Unibell - http://www.uni-bell.org/pubs/sample_sanitary_spec.pdf | <25 gpd/in-mi | <9,600 gpd |
| Infiltration Allowance for Viable Project Alternatives in Fine Screening Report (Gravity) | | 300,000 gpd |

Notes:

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

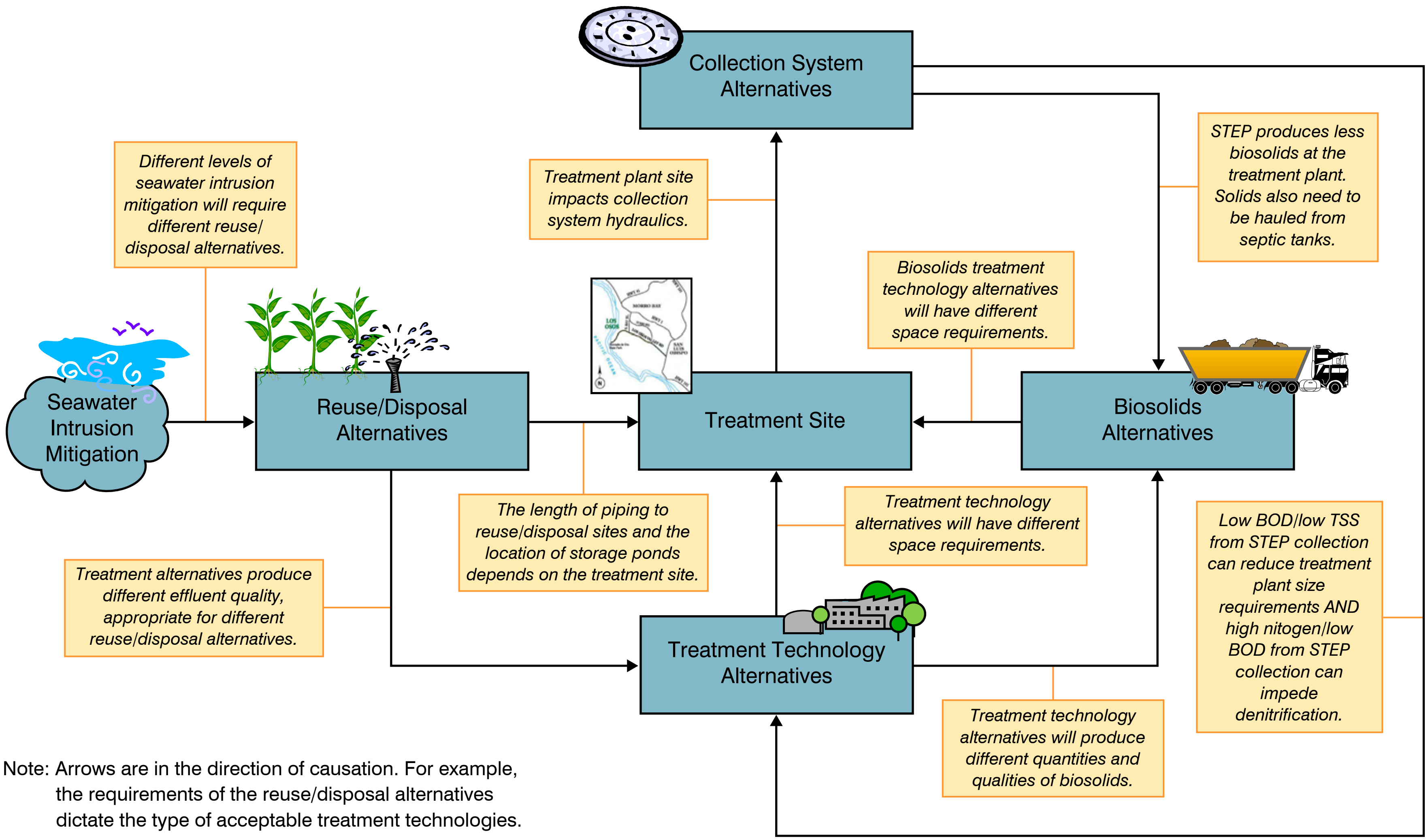
In the Rough Screening Report, 1.3 MGD was identified as the likely wet weather flow for both STEP/STEG and gravity collection systems. However, it was recognized that because of the difference in a pressure tight joint system utilized for STEP/STEG, versus a gasketed bell and spigot joint system utilized for gravity collection system, that there is a higher potential for a gravity system to experience I/I flows over time than there is for a STEP/STEG system. As a result, the wet weather flow for the gravity collection system option was recalculated to be 1.5 MGD (at buildout). This was based on collection system textbook models and was consistent with the calculations previously used by previous studies prior to providing a reduction factor to account for the sandy soils of the area.

The 1.5 MGD does not take into consideration conservation, however, which is a stated goal of the community for the project. With conservation practices, (i.e. toilet retrofit program and water efficient appliances in all new construction) it is estimated that the total flow can be decreased by at least 0.1 MGD. As a result, a likely scenario to anticipate would be that a portion of the increase in I/I flows for the gravity collection system would be offset by the implementation of conservation practices. Therefore, the wet weather flow used to size the wastewater treatment plant for the gravity collection system was 1.4 MGD (1.5 MGD wet weather flow with I/I minus 0.1 MGD of conservation). For sizing of wastewater treatment plant for the STEP/STEG system the reduction in flow due to the implementation of conservation would similarly apply. The wet weather flow used to size the wastewater treatment plant for the STEP/STEG collection was 1.2 MGD (1.3 MGD wet weather flow with minimal I/I, minus 0.1 MGD from conservation).

## 1.4 BASIS FOR SCREENING OF ALTERNATIVES

Each of the component alternatives that passed through rough screening was investigated in greater detail for this Fine Screening Report. Cost is an additional element that will be used for screening in this report that was absent in the Rough Screening Report. Conceptual-level cost estimates have been prepared for the component alternatives to enable their comparison. The interdependency of the components (Figure 1.3) will also be used to examine and screen the component alternatives to a greater extent than was done in the Rough Screening Report. Seawater intrusion mitigation will also be considered, since as discussed in earlier, any project that worsens the current groundwater basin condition will be screened out of consideration. All viable projects were developed so they did not worsen the existing seawater intrusion problem.

Following the development of viable project alternatives, the County's project selection process will include a community-wide survey, workshops, and other community participation efforts so that final project decisions meet the needs and desires of the community to the greatest extent possible. In accordance with State and Federal laws, those additional work efforts and final project selection decisions will be completed concurrently with the environmental review efforts.




Note: Arrows are in the direction of causation. For example, the requirements of the reuse/disposal alternatives dictate the type of acceptable treatment technologies.

**Figure 1.3**
**INTERDEPENDENCY OF PROJECT COMPONENTS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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Since the County's environmental efforts will include extensive community outreach efforts, they are intended to also re-evaluate and either confirm or reject conclusions reached in the most recent Environmental Impact Report certified by the Los Osos Community Services District. The County's efforts provide the basis for maximizing public review and input, developing a community-based decision making process, and requesting property owner decisions on assessment funding through Prop 218 efforts at the earliest appropriate time.

## 1.5 FINE SCREENING REPORT - FOLLOWING SECTIONS

The remainder of the report examines the alternatives for the different project components as follows:

- Chapter 2: Alternatives for reuse/disposal of wastewater effluent are examined and screened.
- Chapter 3: Alternatives for the collection system are examined.
- Chapter 4: Alternatives for wastewater treatment technologies are examined and screened.
- Chapter 5: Alternatives for biosolids treatment and disposal are examined and screened.
- Chapter 6: Alternatives for treatment facility sites are examined and screened.
- Chapter 7: Project components that pass through fine screening are merged with other components in order to create a set of VPAs. Next steps are outlined.

# EFFLUENT REUSE/DISPOSAL

## 2.1 OVERVIEW

In the Rough Screening Report, alternatives for effluent reuse and disposal were established based on standard industry practice and previous efforts to provide wastewater disposal in Los Osos. The previous efforts considered included facilities plans prepared by the County (1998), Montgomery Watson Harza (2001 and 2003), and Ripley Pacific (2006).

The disposal/reuse alternatives that were considered in the Rough Screening Report were:

- Unrestricted Reuse (Agricultural and Urban)
- Percolation Ponds
- Leach Fields
- Spray Fields
- Surface Water Discharge
- Constructed Terminal Wetlands
- Groundwater Injection

> There are many options for groundwater management, including some of the alternatives discussed in this chapter. Ultimately, groundwater management is the responsibility of the water purveyors. The wastewater project itself cannot fully mitigate seawater intrusion and balance the basin. The water purveyors' participation will be necessary in order to fully achieve these community goals in the future.

Surface water discharge and groundwater injection did not pass the rough screening because of the considerable water quality challenges, permitting requirements and cost associated with their implementation compared to other available viable alternatives.

In this chapter, the remaining reuse/disposal alternatives will be combined with other project components to configure potentially viable projects based on their capacity to accept wastewater effluent, their potential to mitigate seawater intrusion, and other factors. These combined reuse/disposal viable projects will be compared to the Tri-W project. For the purposes of the comparison, Tri-W has been modified to reflect current costs and to provide equal disposal capacity.

### 2.1.1 Identification of Reuse/Disposal Alternatives for Potentially Viable Projects

The Rough Screening Report recommended further evaluating five reuse/disposal alternatives. Constructed wetlands passed the rough screening but have been redefined in the fine screening for consideration as a water storage device, rather than a disposal alternative. This is due the lack of permeability of the soils in the area where wetlands would be feasible, as well as the difficulties in maintaining percolation rates in a wetland where biological processes can clog pores in the sediment. The reuse/disposal alternatives considered in this report, as well as potential sites for them, are presented in Table 2.1. “In lieu” reuse denotes that reclaimed water is used for irrigation, thus reducing the

| **Table 2.1** | **Reuse/Disposal Alternatives and Sites<br>Los Osos Wastewater Development Project<br>San Luis Obispo County** |
|---|---|
| **Disposal/Reuse Alternatives** | **Potential Sites** |
| Spray Fields | Tonini ranch and/or smaller sites that are closer to WWTP site |
| Agricultural Reuse (in lieu) | Sites near Los Osos Creek, north of Los Osos Valley Rd. |
| Agricultural Exchange | Sites near Los Osos Creek, north of Los Osos Valley Rd. |
| Other Reuse (in lieu) | Cemetery and WWTP site |
| Urban Reuse | South Bay Community Center, Sunnyside Elementary School, Monarch Grove School, Sea Pines Resort, Baywood Elementary School, Los Osos Middle School |
| Leachfields without Harvest Wells | Broderson site |
| Leachfields with Harvest Wells | Broderson site |
| Percolation Ponds | Broderson site |

groundwater that is pumped from the lower aquifer for this purpose. With "exchange," reclaimed water is used for irrigation, and the groundwater that was previously used for irrigation would be used to supplement the potable water system.

None of these reuse/disposal alternatives under consideration have sufficient capacity to both accept the entire projected wastewater flow *and* mitigate seawater intrusion. As a result, the alternatives will be combined into viable project alternatives for full disposal capacity.

> The Tri-W project included leachfields at the Broderson site and additional sites on the east side of town as the only reuse/disposal alternative. The sum of the capacity for disposal by the sites in the Tri-W project did not meet the required capacity for buildout flow. The shortfall in capacity was deferred to a future project to solve. The east-side leachfield sites also did not provide mitigation for seawater intrusion. Therefore, these east -side sites offered no benefit and are not included in this fine screening.

## 2.1.2 Seawater Mitigation Potential of Alternatives

Seawater intrusion is presently occurring in the lower aquifer, which is the primary drinking water supply aquifer for the community. The interface between seawater and fresh water has moved an estimated 1,200 feet inland over the last 20 years, and elevated chloride concentrations have impacted irrigation and community supply wells in the vicinity of the local golf course. Precursors of intrusion have been detected as far inland as Palisades Avenue, near downtown Los Osos.

It is very difficult to reverse seawater intrusion in a deep aquifer once it has started moving inland.

Those portions of the lower aquifer that have already been intruded are probably permanently lost from the fresh water system. Any future seawater intrusion mitigation efforts, whether associated with the wastewater project or not, will focus on slowing, and ultimately stopping the process of intrusion, which is currently estimated at approximately 460 acre-feet per year (AFY).

Flows from individual residence septic tanks currently mitigate seawater intrusion by approximately 90 AFY. When these flows are collected by a community sewer and therefore are no longer recharging the groundwater basin, seawater intrusion will increase from 460 AFY to approximately 550 AFY. At buildout, seawater intrusion is estimated to increase to 681 AFY. Previous reports have cited higher volumes of seawater intrusion, but some lower aquifer water production has since shifted inland, reducing seawater intrusion by an estimated 100 AFY to the current estimate of 460 AFY.

As discussed in Chapter 1, one of the stated goals of the wastewater project is that it must mitigate seawater intrusion at least to current levels. **Reuse/disposal alternative project components were therefore configured to mitigate at least 90 AFY to the lower aquifer.**

In this report, disposal and reuse alternatives are combined into projects representing several levels of seawater intrusion mitigation. Table 2.2 shows the defined levels of mitigation used in this report. These levels represent the main general benefits of the wastewater project.

**Table 2.2 Levels of Seawater Intrusion Mitigation (Project Benefits)(1)**
**Los Osos Wastewater Development Project**
**San Luis Obispo County**

| Level | Absolute Volume Mitigated (AFY)(2) | Project Impact, Relative to Current Conditions (AFY) | Overall Basin Balance (at Current Pumping Rates) (AFY) | Description |
|---|---|---|---|---|
| Level 0 | 0 | -90 | -550 | No mitigation of seawater intrusion |
| Level 1 | 90 to 140 | 0 to 50 | -460 to -410 | Mitigation of seawater intrusion similar to current conditions |
| Level 2 | 190 to 240 | 100 to 150 | -360 to -310 | Maximum mitigation of seawater intrusion possible without purveyor participation |
| Level 3 | 550 to 600 | 460 to 510 | 0 to 50 | Achievement of a balanced basin at present water use rates |
| Level 4(3) | 780 to 830 | 690 to 740 | 230 to 280 | Achievement of a balanced basin at buildout |

Notes:
(1) In addition to the benefits associated with complying with the WDR.
(2) One acre-foot/year (AFY) is equal to 892 gallons per day (GPD).
(3) Level 3 and Level 4 are possible to achieve, but only with extensive infrastructure reconfiguration by the water purveyors.

There are two ways to mitigate seawater intrusion:

- Reduce production from the lower aquifer.
- Increase recharge to the lower aquifer.

Wastewater disposal strategies are available that utilize each method, as illustrated in Figure 2.1.

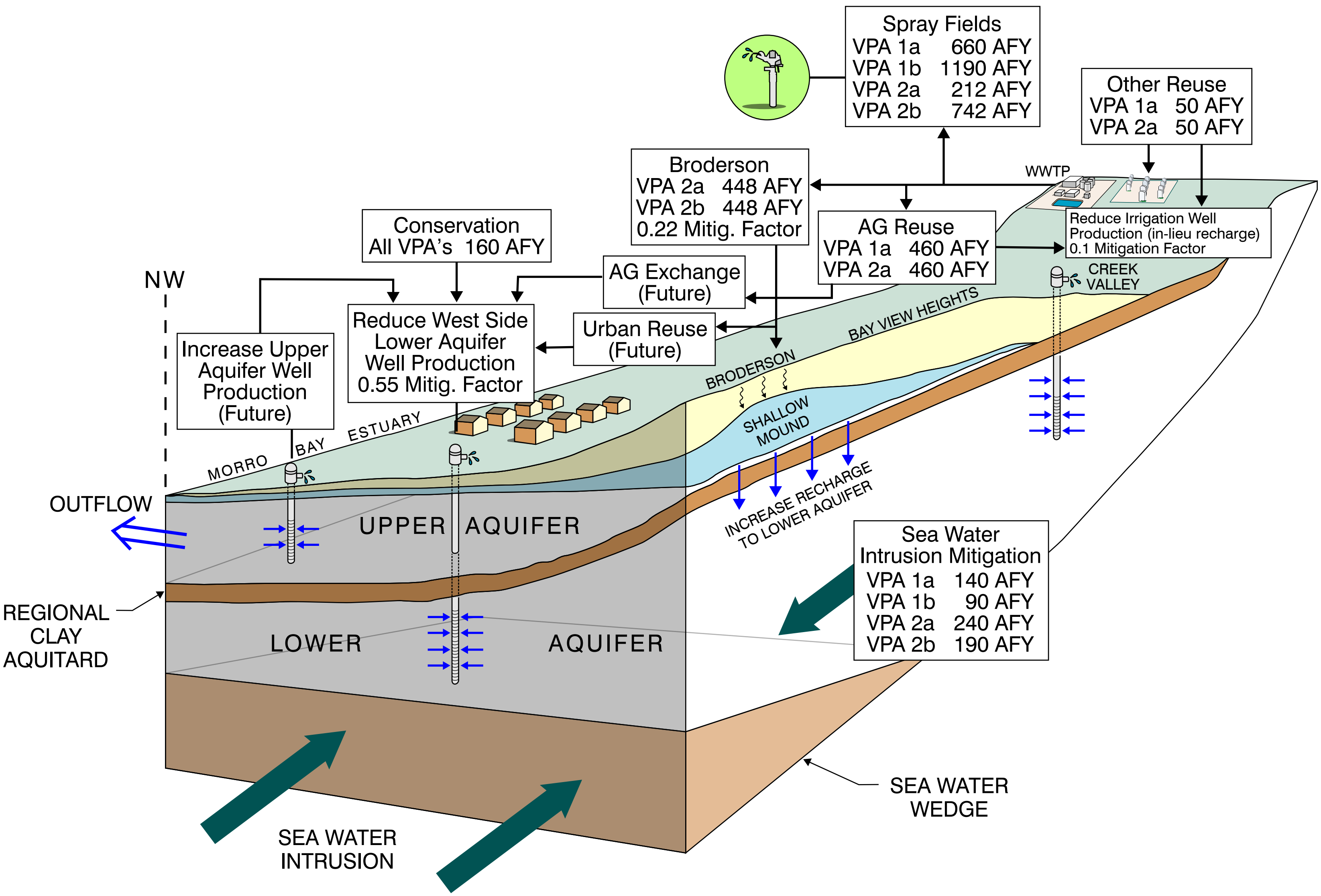


**Figure 2.1**
**SEA WATER INTRUSION MITIGATION STRATEGIES**
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

Cleath & Associates
May 2007

slo507f8-7630.ai

Reductions in lower aquifer production have a greater mitigation value for seawater intrusion the closer they are to the coast. These mitigation values range from 0.55 on the west side of the basin to 0.10 in the Los Osos Creek valley, based on the results of ground water modeling. This means that for every acre-foot of water not removed from the ground, there is a seawater intrusion mitigation benefit of 0.55 AF to 0.10 AF (depending on the location). For example, a value of 0.1 mitigation applies to agricultural reuse where pumping from the lower aquifer beneath the creek valley is reduced by using reclaimed water "in lieu" of wells. In an "exchange" mode, these agricultural wells would continue to pump, and the water would be used in the community supply while the crops would be irrigated with reclaimed water. This "agricultural exchange" water could offset lower aquifer production on the west side of the basin, which would provide the full 0.55 mitigation value.

Current purveyor production from the lower aquifer is estimated to be 1,790 AFY, of which approximately 1,000 AFY is from wells on the west side of the basin where maximum mitigation potential exists. Therefore, the maximum practical seawater intrusion mitigation available from disposal methods that offset lower aquifer purveyor production is estimated to be 550 AFY (i.e. the 0.55 mitigation factor times the 1000 AFY production from the west-side wells). This level of lower aquifer production offset, however, would require significant changes to the water distribution systems that may take years to properly assess, fund, and implement.

Currently, lower aquifer recharge west of the Los Osos Creek Valley comes primarily from upper aquifer leakage. The amount of leakage is controlled by the difference in pressure above and below the regional aquitard. The disposal method that most significantly increases upper aquifer pressure and therefore the lower aquifer recharge on the west side of the basin is the Broderson site. If the Broderson site is utilized for 448 AFY disposal, the resulting seawater intrusion mitigation benefit would be approximately 100 AFY. If the Broderson site is used for 896 AFY disposal, the resulting seawater intrusion mitigation benefit would be approximately 200 AFY.

> Reaching Level 3 and Level 4 seawater intrusion mitigation involves the participation of the water purveyors. Level 3 projects are developed in this report. The difference between Level 3 project and Level 4 projects is <u>entirely</u> composed of actions by the water purveyors and are not related to the wastewater project. Therefore, Level 4 projects are not developed in this report.

## 2.2 REUSE/DISPOSAL ALTERNATIVE CONSIDERATIONS

The ability to provide a viable reuse/disposal component for the wastewater project depends on several factors such as seawater intrusion mitigation, capacity, required treatment level, and the participation from the water purveyors, as discussed below. These factors are summarized in Table 2.3, and discussed in the following sections.

**Table 2.3 Reuse/Disposal Considerations**
**Los Osos Wastewater Development Project**
**San Luis Obispo County**

| Disposal/Reuse Alternatives | Disposal Capacity (AFY) For Fully Developed Alternative[1] | Seawater Intrusion Mitigation Factor | Total Seawater Intrusion Mitigation (AFY) | Denitrification Likely Required (AFY) | Tertiary Treatment Likely Required (AFY) | Requires Purveyors' Participation |
|---|---|---|---|---|---|---|
| Spray Fields | 1,190 | 0 | 0 | No | No | No |
| Cemetery Reuse (in lieu) | 50 | 0.1 | 5 | Partial[2] | Yes | No |
| Urban Reuse (in lieu, large sites) | 63 | 0.55 | 35 | Partial[2] | Yes | Yes |
| Agricultural Reuse (in lieu) | 460 | 0.1 | 46 | Partial[2] | Yes | No |
| Agricultural Exchange | 460 | 0.55 | 250 | Partial[2] | Yes | Yes |
| Leachfields/Percolation Ponds without Harvest Wells (Broderson site) | 448 | 0.22 | 100 | Yes | No | No |
| Leachfields/Percolation Ponds with Harvest Wells (Broderson site) | 896 | <0.22[3] | <200[3] | Yes | No | Yes |
| **Other Actions Influencing Seawater Intrusion Mitigation[4]** | | | | | | |
| Conservation[5] | 160 (at buildout) | 0.55 | 90 | | | No |
| Harvest Water Exchange[6] | none | 0.55 | Up to 550[7] | | | Yes |

Notes:

(1) The project is estimated to require a total disposal capacity of 960 AFY at current conditions and 1350 AFY at buildout, which can be reduced to 1,190 AFY with conservation.
(2) The NWRI report (2006) stated that effluent disposed by land application (i.e., spray irrigation) will not need to undergo nitrogen removal when applied at agronomic rates. However, application of high concentrations of nitrogen would exceed agronomic rates, so partial denitrification to between 10 and 20 mg/L N may be necessary.
(3) Harvesting water to prevent mounding when Broderson is used in excess of 448 AFY reduces the volume of water that percolates to the lower aquifer.
(4) These Other Actions are not reuse/disposal alternatives and therefore do not have an associated capacity.
(5) Conservation is assumed to be achieved through a toilet retrofit program financed by the wastewater project. Although it is not a disposal alternative, it provides an equivalent benefit to 160 AFY disposal capacity.
(6) Does not address wastewater disposal (capacity) and is therefore considered beyond the scope of the wastewater project.
(7) The total mitigation value of harvest water, urban reuse, agricultural exchange, conservation and any other activity that reduced production from the lower aquifer cannot exceed 550 AFY, which is the expected rate of seawater intrusion once septic flows are moved out of town.

### 2.2.1 Capacity of Alternatives

Spray field disposal is the only alternative that has sufficient capacity to accept the entire buildout flow of 1,350 AFY, which corresponds to 1.2 million gallons per day (mgd). However, spray fields do not mitigate seawater intrusion because all the potential sites are located outside the groundwater basin. Therefore, alternatives need to be combined to create a viable project alternative with the capacity to mitigate seawater intrusion (to various levels) and dispose of all the treated effluent. The reuse/disposal viable project alternatives that were carried forward are discussed in Section 2.5.

### 2.2.2 Treatment Requirements

As addressed in the Rough Screening Report, different reuse/disposal options have different treatment requirements. Tertiary treatment and denitrification are the two treatment requirements that will likely differ between the alternatives. Tertiary treatment is required by the California Department of Health Services to protect public health for any alternative where there may be human contact with the water, such as agricultural or urban reuse. Denitrification will be required for alternatives where land application of effluent could lead to nitrate contamination of the groundwater. For example, the spray field alternative offers the opportunity to assimilate effluent nitrogen into plants that are harvested and removed, so denitrification may not be required. Public contact with the effluent can be limited, so tertiary treatment to protect public health may not be necessary for spray fields. Other alternatives will likely require tertiary treatment, denitrification, or both. Alternatives that require tertiary treatment or denitrification will increase treatment costs.

### 2.2.3 Alternatives Requiring Purveyors' Cooperation

Any alternative including a modification or change in operation of current water system practices or infrastructure would require the participation of the water purveyors. Because the maximum benefit for seawater intrusion involves reduced pumping from the lower aquifer, it is only possible to achieve a balanced groundwater basin with purveyor support and cooperation.

Additionally, there are several strategies that are beyond the scope of the wastewater project that the water purveyors could adopt in order to further balance the basin and reduce seawater intrusion, including:

- Pumping the upper aquifer for irrigation, or for treatment and augmentation of drinking water supplies (this includes harvest well production)
- Implementing further conservation measures
- Implementing a storm water runoff detention program for aquifer recharge
- Importing water

## 2.3 POTENTIALLY VIABLE REUSE/DISPOSAL PROJECTS

### 2.3.1 Project Benefits

Benefits for each of the potentially viable projects are based on the levels of seawater intrusion mitigation achieved. Seawater intrusion mitigation can be addressed by a combination of disposal/reuse alternatives that either include the use of the Broderson or use other mitigation and disposal options. As shown in Table 2.4, a Level 1 seawater intrusion mitigation project can be achieved without use of the Broderson site and without purveyor participation. However, beyond Level 1 mitigation, any combination of disposal/reuse options without purveyor participation will require the Broderson site to achieve these levels of project benefit. With purveyor participation, use of Broderson is not necessary to achieve any desired level of seawater intrusion mitigation.

**Table 2.4 Types of Projects**
**Los Osos Wastewater Development Project**
**San Luis Obispo County**

| Project Mitigation Level | Level 1 | Level 2 | Level 3 |
|---|---|---|---|
| With Broderson | ✖ | ✔ | ✔ |
| Without Broderson | ✔ | ✖ | ✔ |

Note: ✔ indicates types of projects that are discussed in this section. ✖ indicates types of projects that were not developed in this report because they were screened out by the criteria listed in section 1.1.2. Alternatives with a hatched background require purveyor participation.

### 2.3.2 Viable Project Alternatives

Based on the goals of the project to mitigate seawater intrusion, provide adequate capacity for wastewater disposal, and to contain project cost, the following considerations were included in developing the short list of viable project alternatives:

- Conservation should be a part of all alternative projects. Conservation works to reduce both wastewater flows and seawater intrusion. A toilet retrofit program has already been approved for the community and the community has consistently supported water conservation.
- Reuse at the cemetery should be part of all alternative projects that already require tertiary treatment. All first-tier alternative plant sites are in close proximity to the cemetery, which

> Level 2 is defined as the project with the maximum seawater intrusion mitigation possible <u>without</u> purveyor participation. Therefore, no Level 2 project that requires purveyor participation was developed.
>
> With purveyor participation, it is possible to reach higher level of seawater intrusion mitigation. Full mitigation (i.e. balancing the basin) requires the reduction of pumping from the lower aquifer and therefore purveyor participation. Level 3 projects with and without the use of the Broderson site were developed as part of this fine screening report.

will minimize the cost of implementing this disposal/reuse option. The cemetery irrigation well is on the west side of the creek valley, and therefore eliminating this pumping results in beneficial seawater intrusion mitigation.

- If Tonini Ranch is selected as a spray field disposal site, the water that is currently being pumped for irrigation at the site could be returned to the water distribution system. This potential alternative has not been investigated yet, nor have costs to implement it been estimated at this time.
- Based on the amount of land used for agriculture, the capacity for agricultural reuse of the wastewater effluent is estimated to be approximately 800 AFY in the Los Osos Creek Valley. Implementation of an agricultural reuse program would likely require a smaller "demonstration" project involving contracts with a few growers. Over time, demonstration of successful reuse at these sites could lead to increased participation in the program by other growers. Alternatively, land could be purchased and leased to growers under the condition that they use recycled water. However, purchase of the land would increase the cost of the project considerably (i.e. by approximately $40,000/acre). Projects with a range of agricultural reuse components will be considered.
- Projects that do not require purveyor participation and, therefore, that are achievable as part of a wastewater project, were given priority in the fine screening process. Projects that required purveyor participation such as upper aquifer harvesting and agricultural exchange were considered to be beyond the scope of the project, although they are still explored in this report. There are several reasons for this exclusion of projects requiring purveyor participation:
  - For the Tri-W project, water purveyor acceptance of upper aquifer harvest water upon initial project start-up was uncertain. The phasing of harvest water into the community supply was to take place after a few years of plant operation, if at all.
  - The feasibility of obtaining contracts for agricultural exchange water is unknown. Agricultural reuse, which is the first step toward agricultural exchange, is likely to begin at a relatively low level and expand over time as growers become accustomed to the practice. Agricultural exchange would evolve in similar fashion, but only after the growers are confident that reuse is a practice that is beneficial to their business.
  - Any new sources of water supply will require purveyors to address both regulatory and infrastructure issues that are outside of the scope of the fine screening process. For example, purveyor pipe diameters may be undersized for accepting a new source at the closest points of delivery. Pressure zone management will almost certainly preclude purveyors from shutting down lower aquifer production wells (as the new sources come on-line) without significant planning, hydraulic modeling, and redesign of the existing water storage and distribution systems.

- Urban in lieu reuse (from upper aquifer or wastewater sources) is not incorporated into the fine screening of the viable project alternatives. The reasons for this were:
  - Any form of urban wastewater/upper aquifer water reuse requires direct purveyor intervention and should be considered primarily a purveyor project. Customer service, meeting on-site regulatory requirements, flow metering, and billing would all be handled by the purveyor.
  - Costs for locally constructed or existing upper aquifer irrigation wells will be much less than using treated effluent to irrigate large parcels due to the pipeline construction costs to convey the effluent several miles from the wastewater treatment facility. For example, costs to run pipelines to large sites in Los Osos are estimated to be approximately $2.5 million, while these sites can only dispose of a small fraction of the effluent (i.e. approximately 68 AFY compared to 1190 AFY total at buildout). The exceptions would be recycled water distribution to Sunnyside School and the Community Park if Broderson is developed, which can potentially accept 10 AFY.
  - Three of the four major urban reuse sites do not significantly mitigate seawater intrusion. The cemetery site (46.9 AFY demand) is already included in the alternative projects. The Tri-W site (21.6 AFY demand) demand will move to wherever the plant is situated. No seawater intrusion mitigation can be credited for irrigating the wastewater treatment plant (WWTP) site, since that demand does not exist in the current condition. Seawater intrusion has already reached the third potential reuse site, Sea Pines Golf course (16.5 AFY demand). Lower aquifer production for golf course irrigation has been minimized due to increasing salt concentrations, and has already been replaced by upper aquifer water and treated wastewater from the Monarch Grove subdivision. The last major reuse site is Los Osos Middle School (24.7 AFY demand), where there is a suitable nearby upper aquifer well (former Walker parcel) that could serve the school at a lower cost than bringing in wastewater, or a new well could be drilled at the Paso Robles harvest well site at a lower cost than bringing in wastewater.
  - Urban reuse of small homeowner parcels is the most expensive disposal method. Cost estimates for delivering reclaimed water to each residence indicate that this option would be comparable to the installation of the collection system (i.e. tens of millions of dollars). Since this is much more expensive than any other viable reuse/disposal alternative, it did not pass fine screening.
- Percolation ponds (as rapid infiltration basins) are only feasible in permeable soils. Prior surveys of the percolation capacity of local soils have effectively ruled out rapid infiltration basins for areas not underlain by dune sands. Within the dune sands, the Broderson site is the preferred location for percolation of treated wastewater, based on a greater disposal capacity and mitigation potential for seawater intrusion.

Therefore, the only location at which percolation ponds were considered is the Broderson site.

In 1987, the County Board of Supervisors approved effluent disposal using percolation ponds at the Broderson site. However, at that time the community had concerns regarding potential flow releases of effluent, odor issues, vector propagation, and habitat loss. Percolation ponds at Broderson would result in permanently lost habitat to sensitive species.

**For the purposes of this report, percolation ponds will be considered equivalent to leachfields since they both are located at the same site, and they have the same capacity and seawater intrusion mitigation potential. Both of these alternatives will be referred to as "Broderson."** Leachfields have many advantages over percolation ponds, but if the community decides in the future that percolation ponds are acceptable, this will likely result in a lower capital cost of more than $2.5 million compared to an analogous project with leachfields.

## 2.4 REUSE/DISPOSAL VIABLE PROJECT CONFIGURATIONS

For seawater intrusion mitigation Levels 1 and 2, reuse/disposal alternatives can be developed that do not require the water purveyors' participation. Each of the projects dispose of 1,190 AFY of effluent, which is the anticipated flow at buildout with conservation. For all Level 3 projects, purveyor participation is required.

Two Level 1 alternative projects are described in Table 2.5. One of these projects includes 460 AFY of agricultural reuse (pending the actual volume of effluent that growers will agree to accept); the other does not include agricultural reuse.

**Table 2.5 Level 1 Projects**
**Los Osos Wastewater Development Project**
**San Luis Obispo County**

| | | |
|---|---|---|
| **Project 1a - Full Agricultural Reuse** | | |
| **Alternative Component** | **Capacity** | |
| Spray Fields (170 acres) | 680 | **Total Seawater Intrusion Mitigation = 140 AFY**<br>**Total Capital Cost = $12.7M-14.3M**<br>**Total O&M = $100-190K/year(1)** |
| Agricultural Reuse | 460 | |
| Conservation | 160 | |
| Other Reuse (cemetery) | 50 | |
| Storage (290 ac-ft) | | |
| **Project 1b - No Agricultural Reuse** | | |
| **Alternative Component** | **Capacity** | |
| Spray Fields (280 acres) | 1190 | **Total Seawater Intrusion Mitigation = 90 AFY**<br>**Total Capital Cost = $12.8M-15.6M**<br>**Total O&M = $125-275K /year(2)** |
| Conservation | 160 | |
| Storage (210 ac-ft) | | |

Notes:
(1) Energy comprises $100-140K of O&M (electricity at 12 cents/kWh).
(2) Energy comprises $125-185K of O&M (electricity at 12 cents/kWh)

Both projects rely heavily on spray field disposal.

Two Level 2 alternative projects are described in Table 2.6, both of which include leachfields at the Broderson site. Similar to the Level 1 alternatives, one of these projects does not include agricultural reuse, the other assumes 460 AFY of agricultural reuse. Both projects include spray field disposal because the other alternatives that are within the scope of the wastewater project (i.e., that do not require purveyor cooperation) do not have sufficient capacity to accept the full effluent flow.

**Table 2.6 Level 2 Projects**
**Los Osos Wastewater Development Project**
**San Luis Obispo County**

| **Project 2a - Full Agricultural Reuse** | | |
|---|---|---|
| **Alternative Component** | **Capacity** | |
| Spray Fields (70 acres) | 232 | **Total Seawater Intrusion Mitigation = 240 AFY**<br>**Total Capital Cost = $13.2-13.9 M**<br>**Total O&M = $370-410K/year(2)** |
| Broderson (half)(1) | 448 | |
| Agricultural Reuse | 460 | |
| Conservation | 160 | |
| Other Reuse (cemetery) | 50 | |
| Storage (140 ac-ft) | | |
| **Project 2b - No Agricultural Reuse** | | |
| **Alternative Component** | **Capacity** | |
| Spray Fields (180 acres) | 742 | **Total Seawater Intrusion Mitigation = 190 AFY**<br>**Total Capital Cost = $14.9-16.7 M**<br>**Total O&M = $340-430K/year(3)** |
| Broderson (half) | 448 | |
| Conservation | 160 | |
| Storage (30 ac-ft) | | |

Note:
(1) Using Broderson at half of its full capacity of 896AFY is the maximum flow that does not require harvest wells.
(2) Energy comprises $280-300K of O&M (electricity at 12 cents/kWh).
(3) Energy comprises $250-290K of O&M (electricity at 12 cents/kWh).

Table 2.7 describes two Level 3 projects. Project 3a includes Broderson leachfields operating at 3/4 capacity (with 1/3 of this flow harvested to control rising groundwater near the bay) and project 3b does not include the Broderson site. These projects both contain agricultural exchange, where water that is currently used for irrigation will be diverted into the drinking water distribution system. To balance the basin at current conditions, the 3b project will require either a shift in water production to the upper aquifer, importation of water, or another change in water supply strategies. Project 3b is essentially the same as 1a, except that it includes agricultural exchange rather than in lieu of reuse, and it includes a shift in water production that is unrelated to effluent reuse/disposal.

| Table 2.7 | Level 3 Projects<br>Los Osos Wastewater Development Project<br>San Luis Obispo County | |
|---|---|---|
| **Project 3a - With Broderson** | | |
| **Alternative Component** | **Capacity (AFY)** | |
| Spray Fields (10 acres) | none during normal precipitation years | |
| Broderson (3/4) | 680 | **Total Seawater Intrusion Mitigation = 600 AFY** |
| Harvest as Offset (232 AFY) | | **Total Capital Cost = $25.6-27.3M** |
| | | **Total O&M = $320K/year(3)** |
| Agricultural Exchange | 460 | |
| Conservation | 160 | |
| Cemetery | 50 | |
| Storage (115 ac-ft) | | |
| **Project 3b - Without Broderson** | | |
| **Alternative Component** | **Capacity (AFY)** | |
| Spray Fields | 680 | |
| Agricultural Exchange | 460 | |
| Other Reuse (Cemetery) | 50 | **Total Seawater Intrusion Mitigation = 550 AFY** |
| | | **Total Capital Cost = $26.0-29.8 M(2)** |
| | | **Total O&M = $130-1100K/year(2,4)** |
| Conservation | 160 | |
| Shift in Water Production (400 ac-ft)(1) | | |
| Storage (290 ac-ft) | | |

Notes:
(1) Shift in water production could involve water importation, upper aquifer pumping or other strategies.
(2) Lower range of costs are for upper aquifer treatment; upper range of costs are for water importation.
(3) Energy comprises $210K of O&M (electricity at 12 cents/kWh).
(4) Energy comprises $120-490K of O&M (electricity at 12 cents/kWh).

Because both Level 3 projects will involve substantial participation by the purveyors beyond the control of the wastewater project, and expenditures on their part, there is greater uncertainty in these cost estimates than for Level 1 and 2 projects.

### 2.4.1 Tri-W Project Effluent Disposal

As shown in Table 2.8, the Tri-W project effluent disposal included leachfields at the Broderson site, the Pismo site and the Santa Maria site. Because the Pismo Site and Santa Maria site are both on the east side of town, their use as leachfields does not provide any benefit for seawater intrusion mitigation. These three sites combined have a total capacity of 1255 AFY. However, in order to prevent groundwater mounding beneath Broderson, approximately 448 AFY needs to be harvested and disposed/reused. The Tri-W project did not set forth a solution for dealing with the harvest water.

**Table 2.8 Tri-W Project Effluent Disposal**
**Los Osos Wastewater Development Project**
**San Luis Obispo County**

| Alternative Component | Capacity (AFY) | |
|---|---|---|
| Broderson (full) | 896 | **Total Seawater Intrusion Mitigation = 285 AFY**<br>**Total Capital Cost = $19.7-22.8M(1)**<br>**Total O&M = $320-370K/year(2** |
| Harvest as Offset (448 AFY) | | |
| Spray Fields for harvest water (100 acres) | 448 | |
| Santa Maria | 147 | |
| Pismo | 147 | |
| Conservation | 160 | |

Notes:

(1) Capital Costs presented are based on bid tabs, escalated to 2007 dollars and added to additional cost of spray field harvest water disposal and the conservation program.

(2) Energy comprises $240-250K of O&M (electricity at 12 cents/kWh).

In order to provide a fair comparison to the other reuse/disposal projects presented in this section, spray fields have been added to the Tri-W project as a means of disposing of the harvest water. Additionally, for the purposes of comparison, conservation was added to the Tri-W project, as it was a baseline assumption for all other projects described in the previous section.

### 2.4.2 Seasonal Flows

The effluent flows to each of the reuse/disposal components in a project will not be constant throughout the year. The seasonality of these flows for the Level 1 and 2 projects is illustrated in Figure 2.2, and the quantitative monthly flows to each reuse/disposal component is graphed in Figure 2.3.

Agricultural reuse will only occur during the growing season, with peak reuse flows in July. There will be no agricultural reuse between December and February. For the project alternatives that include leachfields at the Broderson site, most of the winter flows can be accommodated there. However, the maximum daily capacity of the Broderson site is less than the total effluent flow. Spray fields, while operable to some extent in the winter months, have less capacity during the rainy season than the dry season, and likely cannot be operated during rainstorms. These factors necessitate the availability of winter storage. Projects that include leachfields and Broderson will need less storage, as will projects that do not include agricultural reuse, since that is the most strongly seasonally dependent reuse/disposal alternative. Water that is stored during the winter will be sent to spray fields during the spring months (except for project 3a, where most of the stored water will be sent to Broderson, since the spray fields are only for wet-year disposal).

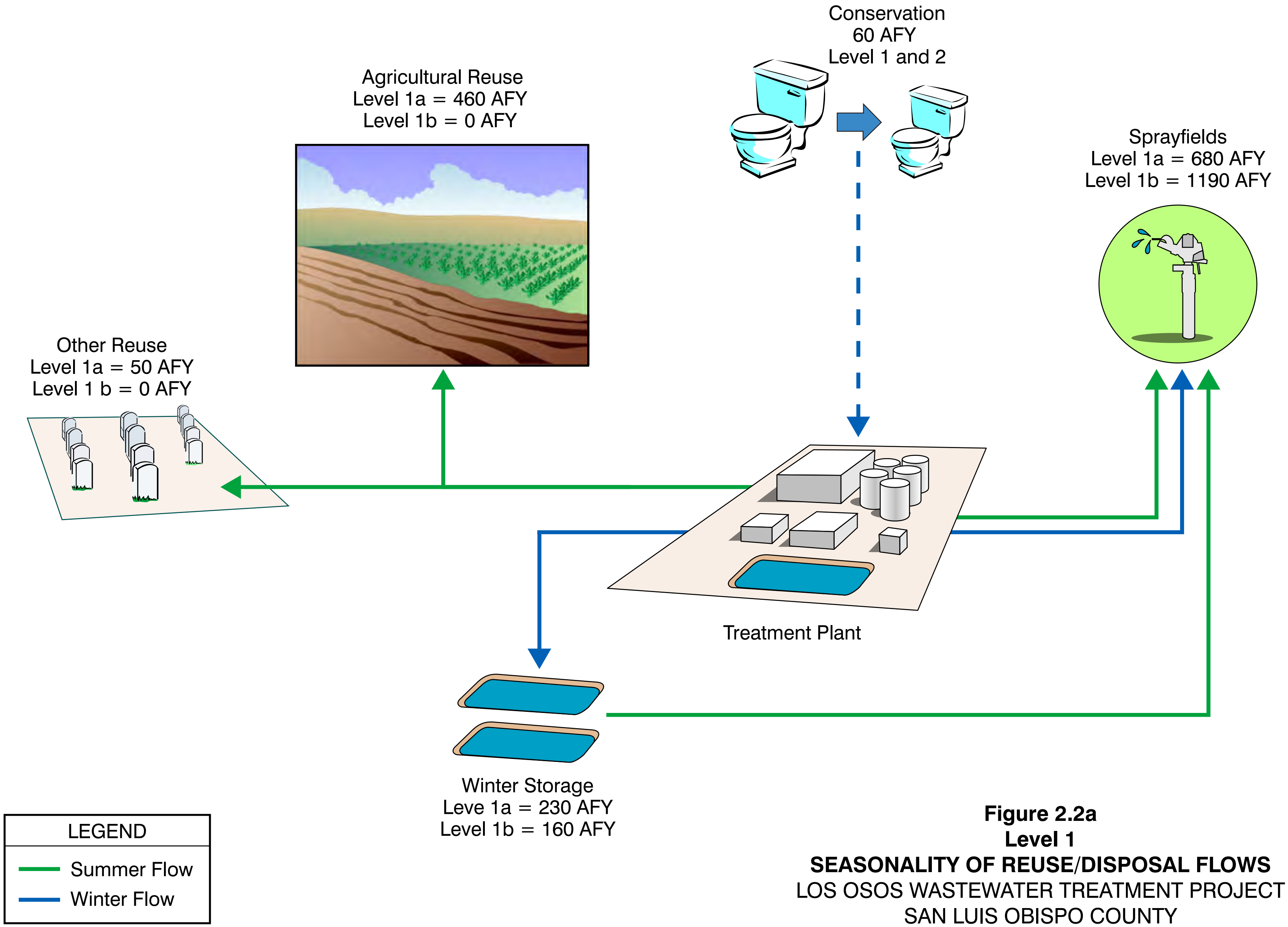


**Figure 2.2a**
**Level 1**
**SEASONALITY OF REUSE/DISPOSAL FLOWS**
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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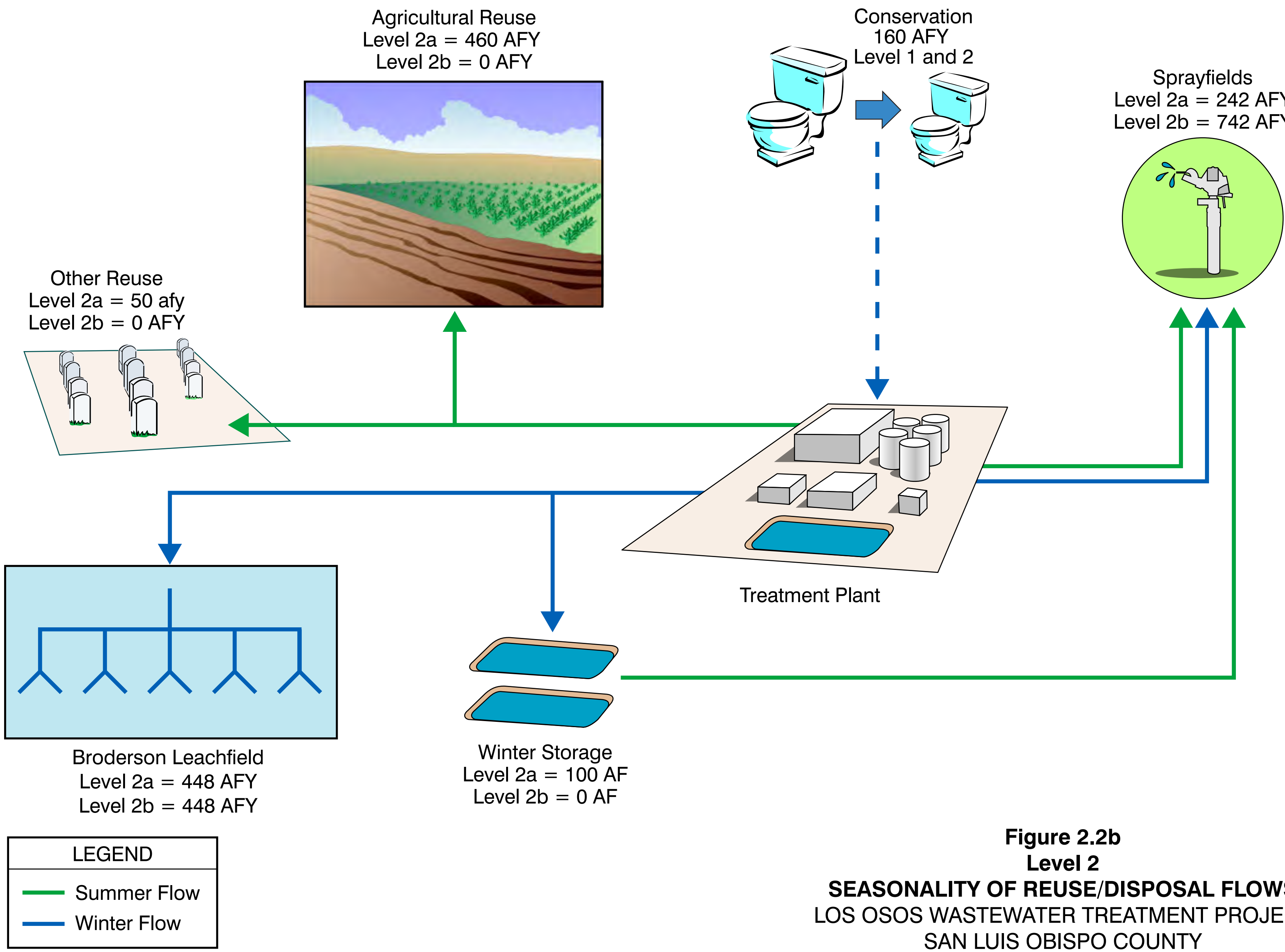


**Figure 2.2b**
**Level 2**
**SEASONALITY OF REUSE/DISPOSAL FLOWS**
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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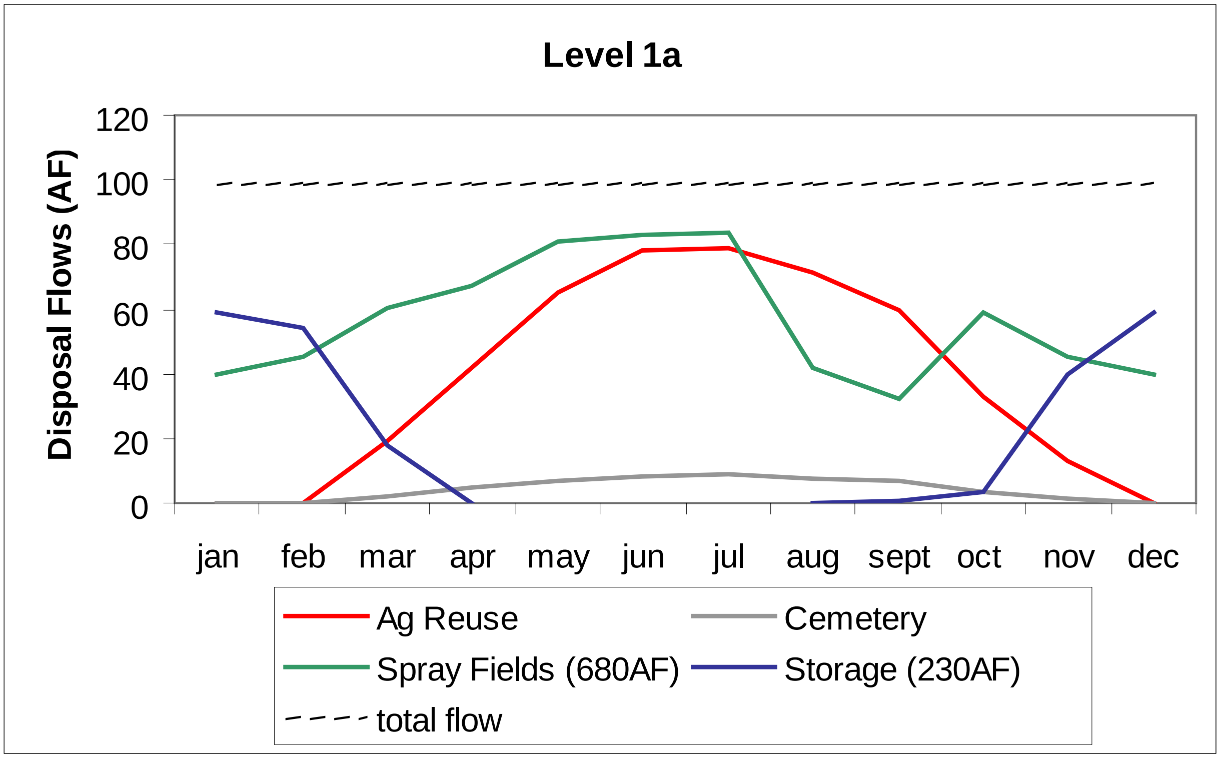


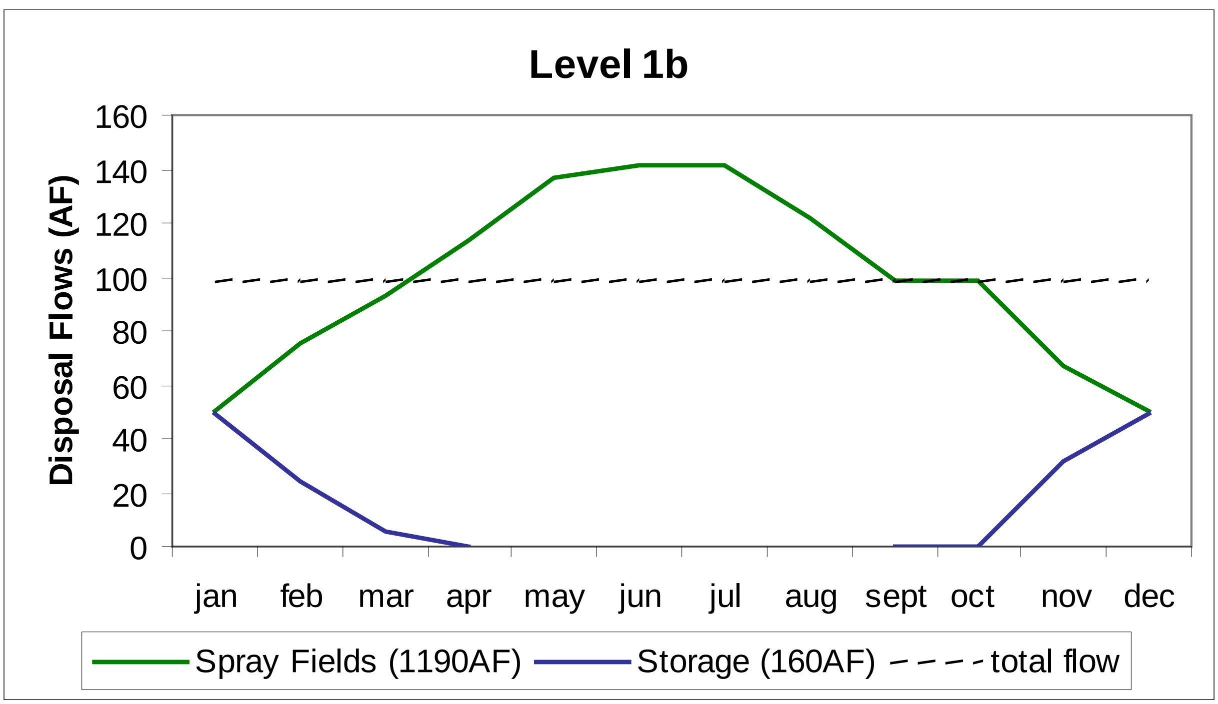


**Figure 2.3a**
**Level 1**
**MONTHLY FLOWS FOR REUSE/DISPOSAL PROJECTS**
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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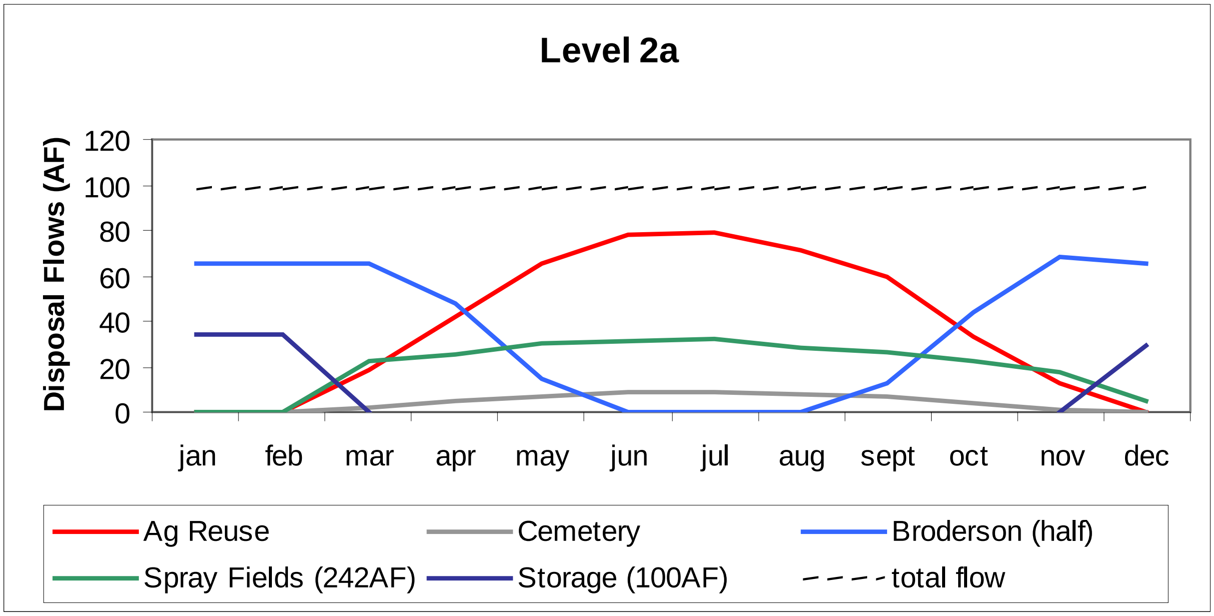


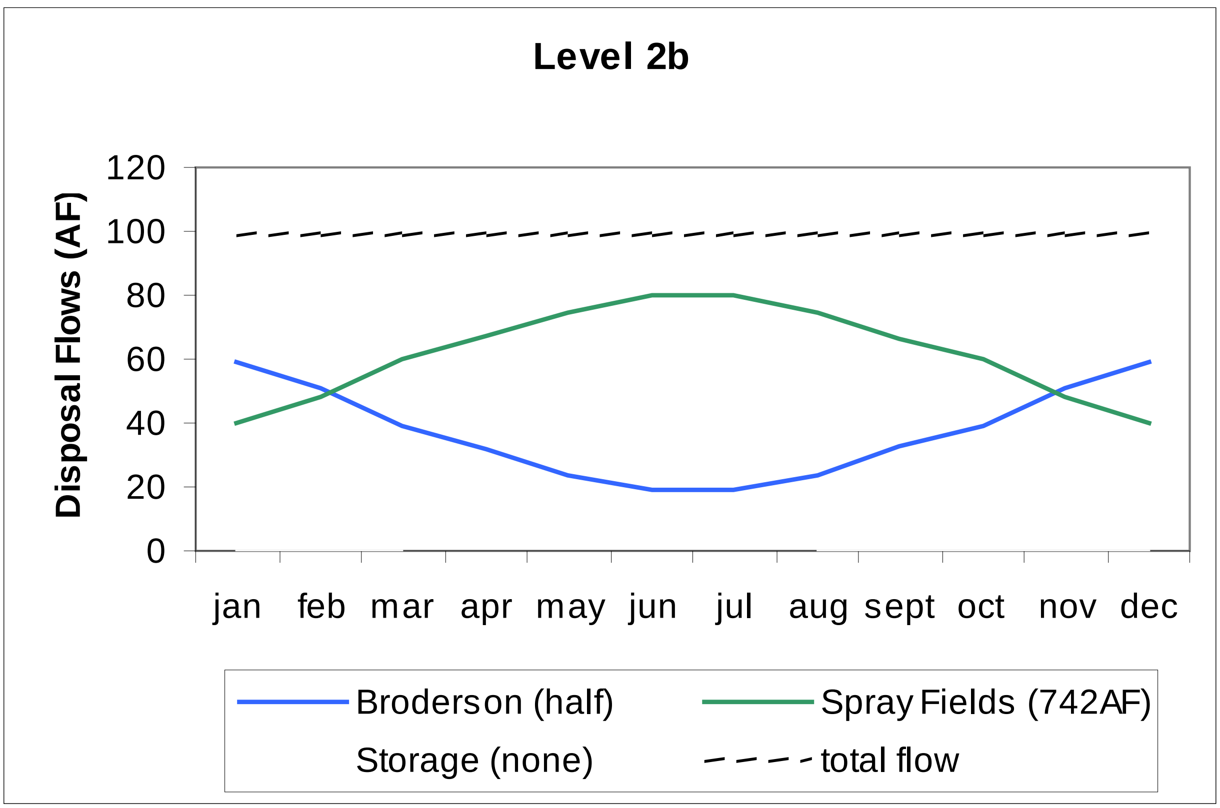


**Figure 2.3b**
**Level 2**
**MONTHLY FLOWS FOR REUSE/DISPOSAL PROJECTS**
LOS OSOS WASTEWATER TREATMENT PROJECT
SAN LUIS OBISPO COUNTY

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During extremely wet years, the ability to dispose of water in spray fields as well as the demand for water from agricultural users will be diminished. This necessitates building extra storage capacity, as well as developing extra spray field capacity to dispose of the stored water at the end of the wet season. It was assumed that no agricultural reuse will occur between early November and late March in a wet year, so extra storage must be provided. Additionally, it was assumed that spray field use will be diminished in wet years, so flows equivalent to half of the month of March's spray field use will need to be withheld (because March is the month of the wet season where reliance on spray fields is greatest in every project scenario). The additional spray field capacity needed to dispose the effluent stored during a wet year was included in the cost of land acquisition.

Storage ponds can be planted with vegetation in order to allow them to function as wetlands. This option would provide the benefits of supplying wildlife habitat and possibly removing some wastewater contaminants such as metals. However, managing the storage ponds as wetlands would likely increase the levels of BOD, TSS and pathogens in the treated effluent. The quality of water required for the end use or disposal must be considered when determining if wetlands as storage would be suitable.

### 2.4.3 Reuse/Disposal Costs

The costs for the reuse/disposal projects increase with increased seawater intrusion mitigation (Figure 2.4). However, the costs for a Level 2 project are not substantially greater than for a Level 1 project.

The elements that make up the capital and O&M costs and are presented in Tables 2.5-2.7 are also presented in Appendix A.

When alternatives are combined to make viable reuse/disposal projects, there is some cost savings associated with those combinations. For example, when agricultural reuse is combined with Broderson, assuming that the treatment plant is located near Los Osos Valley Road, east of the creek, a single pipe can carry flows destined for both purposes from the treatment plant to the creek crossing.

Each of the cost estimates in Tables 2.5-2.7 is a range that reflects the cost of harvesting the spray fields. As discussed ahead in section 2.5.2, if the spray fields are required to provide the bulk of the nitrogen removal in the wastewater project, then the grasses growing on the sprayfields will have to be frequently harvested to promote nitrogen uptake. This translates to increased capital costs for machinery, and O&M costs for fuel and labor. However, if the costs for denitrification are shifted to the wastewater treatment plant, then the sprayfields do not need to be harvested.

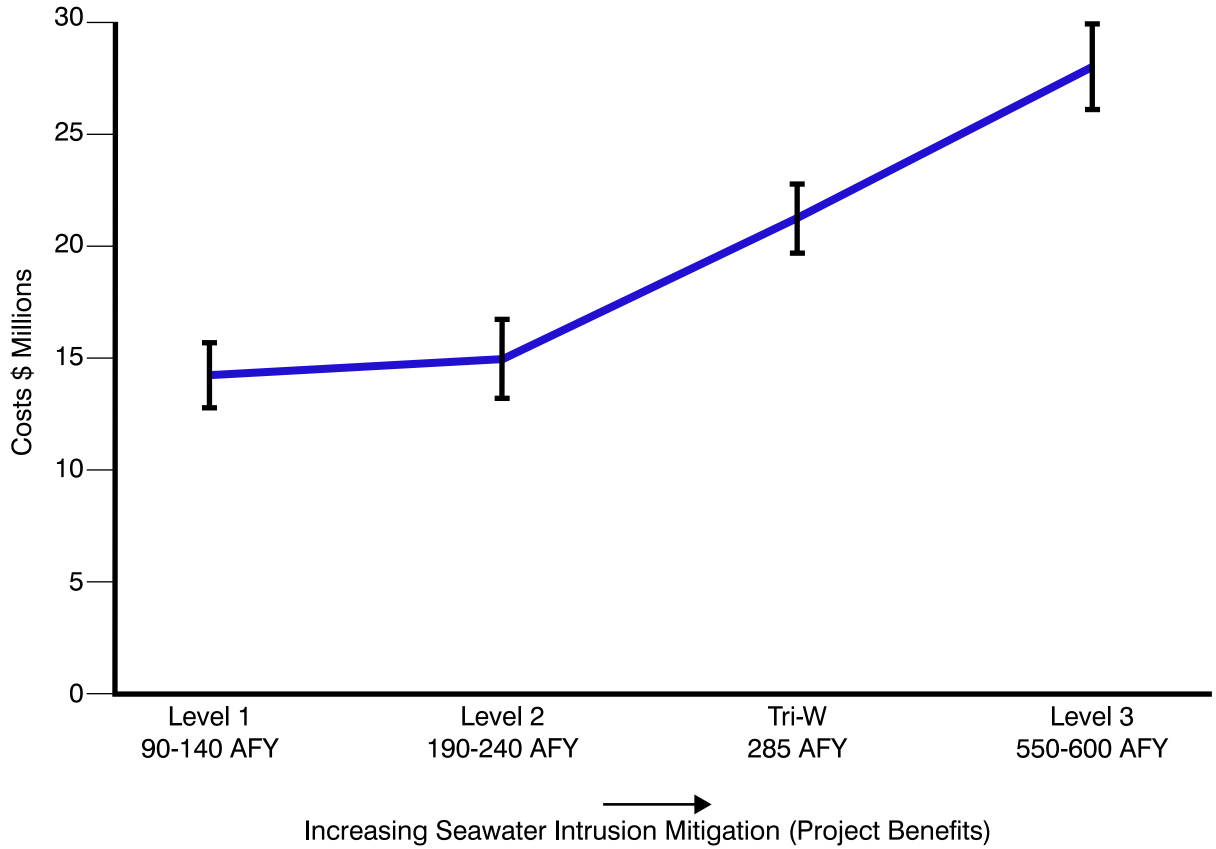


**Figure 2.4**
**COST RANGES OF REUSE/DISPOSAL PROJECTS**
**ALTERNATIVE COST-BENEFIT CURVES (ILLUSTRATIVE)**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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### 2.4.4 Project Phasing

> Level 3 and Level 4 projects can only be implemented by the water purveyors, due to the changes required by the purveyors of system infrastructure and operational practices.

It is possible that if a Level 1 or Level 2 project was adopted, at some later date the water purveyors could update their infrastructure to move to a Level 3 or Level 4 project. The viable projects considered in this fine screening report are configured such that there will be no stranded assets when transitioning to a higher level of seawater intrusion mitigation.

## 2.5 OTHER CONSIDERATIONS

Besides those mentioned in the previous section, other considerations impact the project selection process. Among these are the salt and nitrogen loading into the groundwater as a result of wastewater disposal/reuse, as well as other environmental, geotechnical and permitting issues. These are described in the follow sections.

### 2.5.1 Salt Loading

Salt loading involves the progressive mineralization of groundwater from domestic and agricultural use. The wastewater project involves a redistribution of septic flows collected in the prohibition zone, which can affect salt loading in the groundwater basin. This section compares differences in basin salt loading between the current condition and the viable project alternatives.

#### 2.5.1.1 <u>Current Condition</u>

The total septic flow in the urban area is currently estimated to be 1,240 AFY. Most of these septic returns (1,120 AFY) are in the prohibition zone, and will be collected by the wastewater project. After perching layer effects, the amount of septic returns from the prohibition zone currently returning to the upper aquifer is estimated at 850 AFY.

Residential water use typically adds 200 to 300 milligrams per liter (mg/L) total dissolved solids (TDS) to the water supply, in a process called “salt pickup”. A review of monitoring data for local wastewater dischargers indicates that salt pickup in Los Osos appears closer to the low end of the range. The average TDS of the district municipal water supply in Los Osos has varied between approximately 320 and 510 mg/L in the last several years. Assuming an average water supply TDS of 420 mg/L, and a 200 mg/L salt pickup from the domestic reuse cycle, the wastewater TDS would be estimated at 620 mg/L. Recent (October 2006) sampling of septic effluent at Bayridge Estates and Vista de Oro measured 600 mg/L and 690 mg/L TDS, respectively.

**Level 1**

Wastewater under Level 1 projects would be distributed to spray fields outside of the basin and used for irrigation in the creek valley, at the cemetery, and at the plant site. Upper aquifer salt loading in the urban area would decrease by the total TDS content of the 850 AFY of septic return flows under current conditions, which is up to 720 tons TDS per year for Level 1 projects.

Some of the salt removed from the urban area would be applied as irrigation and percolate to aquifers underlying the Los Osos Creek valley. The average TDS in the creek valley aquifers is approximately 520 mg/L. Replacement of groundwater irrigation with wastewater irrigation is on an equal volume basis. At approximately 620 mg/L, the TDS content of Los Osos wastewater would be 100 mg/L greater than the average TDS of creek valley water. Some crops are more sensitive to salts than others, but a change in salinity from 520 mg/L to 620 mg/L TDS would not be expected to affect crop yield in the creek valley. A more detailed analysis of individual water quality constituents could be also performed, however, Los Osos wastewater quality is expected to be suitable for irrigation.

**Level 2**

Wastewater under Level 2 would also be distributed to spray fields outside of the basin and used for irrigation in the creek valley, at the cemetery, and at the plant site. However, in addition there would be 448 AFY disposal at the Broderson site, which would percolate to the upper aquifer. Salt loading in the urban area would decrease by an estimated 380 tons TDS per year under VPA 2, although the decrease would not be evenly distributed, and would mostly benefit the east side of the basin (Baywood Park). On the west side, with Broderson operating at 448 AFY (half of maximum capacity), the salt loading would be similar to current conditions.

### 2.5.2 Nitrogen Loading

Because nitrogen contamination is the primary driver of the wastewater treatment project, any disposal/reuse alternative that is selected must not exacerbate nitrate concentrations in the groundwater. With an average flow of 1.2 MGD and an effluent nitrogen concentration of between 7 mg/L and 54 mg/L (see Chapter 4), the nitrogen loading for disposal/reuse will be between 290 lbs/day and 2,200 lbs per day. Under current conditions, all nitrogen is discharged to the soils overlying the upper aquifer.

**Sprayfields**

If the effluent is disposed via sprayfields, then further nitrogen removal can be achieved at the sprayfield site. Residual ammonia will evaporate or quickly be converted to nitrate by biological processes. Approximately 15-25 percent of the nitrate will likely be removed though denitrification in the soil, which converts it to nitrogen gas. If perennial forage crops are planted and frequently harvested, some species can remove up to 2100 lbs/acre/year of nitrogen under ideal conditions. With the highest loading rate of nitrogen, corresponding to a concentration of 54 mg/L, at least 300 acres of spray fields are needed to reduce the concentration of nitrogen to below the drinking water limit of 10mg/L in the groundwater beneath the fields. Under real conditions, more acreage would probably be required. However, it is unlikely that a project will be carried forward that includes effluent nitrogen concentrations of 54 mg/L.

**Agricultural Reuse**

The considerations for nitrogen loading for agricultural reuse are similar to that of spray fields. However, annual plants have a lower capacity for nitrogen uptake than do perennials, since they are not frequently harvested and therefore spend less of the year in a rapid growth phase. This means that more land would be required to apply the nitrate at agronomic rates.

Because the potential agricultural reuse sites are within the groundwater basin, lower concentrations of nitrogen in the irrigation water may be necessary in order to protect the groundwater during periods when the crops are not uptaking large amounts of nitrogen. Concentrations of 10 to 20 mg/L nitrogen could probably be used for crop irrigation without leading to nitrate contamination in the groundwater.

**Broderson**

If the effluent is disposed at the Broderson site, then an effluent limit of 7 mg/L will be required. Over many years, the water beneath the Broderson site will achieve a steady-state nitrogen concentration that should not exceed that of the effluent.

### 2.5.3 Environmental/Geotechnical/Permitting Considerations

Each of the reuse/disposal alternatives under consideration has its attendant environmental and permitting considerations.

#### 2.5.3.1 Sprayfields

Sprayfields require large tracts of land, up to 270 acres depending upon soil conditions, to accommodate the entire effluent (up to 1,190 AFY). Effects include the following:

- There is the possible loss of agricultural viability; although sprayfields can be used for grazing.
- Year-round watering would cause a change in the scenic vista. Areas that previously turned brown in all but the winter and spring months would be green all year.
- Effluent constituents would change the soil makeup over time, adding sediments and salts.
- Sprayfields can only be used in weather conditions where winter runoff can be prevented.

#### 2.5.3.2 Urban Re-Use of Treated Wastewater

The re-use of treated wastewater would necessitate the extension of distribution pipes from the treatment plant and/or disposal sites to play fields or landscaping where the water would be used. Impacts associated with the construction of these pipes would be comparable to those associated with the wastewater collection and disposal system. Impacts associated with the crossing of Los Osos Creek with a disposal main are discussed in Chapter 6.

#### 2.5.3.3 Leachfields/Percolation Ponds

For leachfields or percolation ponds to be effective, they would need to be located over the Los Osos dune sands, west of Los Osos Creek where percolation rates are high. Any leachfield approach would likely include the Broderson parcel. Possible impacts of leachfields/percolation ponds include the following:

- There will be short-term construction impacts.
- There may be habitat loss for Morro shoulder band dune snails and other special status plants and animals. The Broderson parcel is located in the more pristine area of habitat. While the leachfields could be restored after installation, they would require periodic (every ten years) replacement. With percolation ponds, the habitat loss would be permanent. The costs for environmental mitigation of percolation ponds could be substantial.

#### 2.5.3.4 Storage Ponds

Winter storage requirements would necessitate the development of ponds, as described in Section 2.5.3. Storage ponds would require up to 30 acres. The potential environmental consequences associated with storage ponds are:

- There are temporary erosion and surface water quality issues associated with construction activities. These impacts can be effectively addressed by adherence to the requirements of the County grading regulations and the application of Best Management Practices as required by a National Polluant Discharge Elimination System (NPDES) permit.
- Should the ponds be located on the High Priority treatment facility sites (refer to Chapter 6) the construction of 30 acres of storage ponds would result in the permanent conversion of Class III soils to a non-agricultural use (even though the stored water may ultimately be used to support ongoing agricultural operations). Surrounding properties where spray fields are contemplated are largely Class III soils, with smaller areas of Class II soils.

- Fault Risk. As discussed in Chapter 6, strands of the Los Osos Fault have been mapped in the vicinity of the High Priority treatment plant sites. Thus, the placement of storage ponds in this area may require the design to address surface displacement that may arise from a seismic event. A site-specific geotechnical investigation should be performed to ensure the pond(s) are not placed over a fault trace.
- Slope stability. Portions of the High Priority treatment plant sites and surrounding properties possess steep slopes and exhibit evidence of slope instability. Ponds will need to be located in areas where the slope is stable, or is capable of being stabilized to support the walls of the pond.

# COLLECTION SYSTEM ALTERNATIVES

## 3.1 COLLECTION SYSTEM OVERVIEW

### 3.1.1 Rough Screening Alternatives

The Potential Viable Project Alternatives Rough Screening Analysis (Carollo, March 2007) recommended three alternatives for further evaluation. The alternatives include gravity similar to the system designed and permitted as part of the previous Tri-W Project, septic tank effluent pumping/septic tank effluent gravity (STEP/STEG) collection, and a combined gravity/vacuum/low pressure system.

#### 3.1.1.1 Combined Gravity/Vacuum/Low Pressure Collection System

The gravity collection system is a mostly passive central sewer system that uses gravity to move wastewater. Based on topography, it is necessary to employ lift stations at various locations throughout the collection system to move wastewater to the treatment facility.

The combined system consists of gravity, vacuum, and/or low-pressure collection systems depending on the localized topography throughout the system. The combined system allows for optimization of construction and operation and maintenance (O&M) costs as compared to a dedicated gravity system. The previously designed gravity system included elements of a low pressure system (grinder pumps) and would serve as the starting point for this option. Additional vacuum and low pressure elements would be incorporated in locations where topography, groundwater, or other site-specific conditions dictate.

Modifications to the previously designed gravity/low pressure system will not be examined in detail in this fine screening analysis. Modifications are viewed as a value-engineering alternative where additional vacuum and low-pressure equipment will be employed in the gravity collection system, if appropriate, to reduce costs. Assessment of site-specific options requires detailed design analysis and is beyond the scope of this report. Cost savings for the combined system are expected to be modest. The previously designed gravity/low pressure system is assumed to provide a conservative estimate of the capital and O&M costs.

#### 3.1.1.2 STEP/STEG Collection System

A STEP/STEG collection system utilizes septic tanks to settle solids and provide a primary level of treatment. The effluent from the tanks is conveyed to an in-street collection system and the treatment facility via pumping (STEP system) or gravity (STEG system) through small diameter, pressurized pipes.

### 3.1.2 Cost Baseline

#### 3.1.2.1 Gravity/Low Pressure Collection System

A gravity/low pressure collection system was designed as part of the previous Tri-W Project. Table 3.1 provides information on the final engineer's estimate and bid tab values for the collection system. The final engineer's estimate was approximately $56.2 million escalated to April 2007 dollars. Bid tab values totaled approximately $67.4 million when escalated to April 2007 dollars. (Note that this does not include approximately $9.5 million (April 2007 dollars) for bid items associated with effluent disposal and harvest wells in the bid schedule.) The bid tabs did not include on-lot lateral costs. The estimates assume conveyance to the Tri-W site. For other locations, additional conveyance costs would likely be incurred for additional facilities or a modified design.

**Table 3.1 Final Estimate and Bid Tab Values for Gravity/Low Pressure Collection System
Los Osos Wastewater Project Development
San Luis Obispo County**

| Item | Quantity [(1)] | Engineer's Estimate ($M) [(2,3)] | Bid Tab Cost ($M) [(1,3)] |
|---|---|---|---|
| Mobilization/Demobilization/General Conditions | Lump Sum | 2.6 | 4.2 |
| Gravity Sewers and Force Mains | 230,000[(4)] | 17.1 | 29.7 |
| Manholes | 807 | 4.0 | 5.8 |
| Shoring and Dewatering | Lump Sum | 2.2 | 5.7 |
| Duplex Pump Station | 6 | 1.1 | 2.6 |
| Triplex Pump Station | 2 | 0.4 | 1.2 |
| Pocket Pump Station | 12 | 1.0 | 2.4 |
| Standby Power Facility | 7 | 1.8 | 2.5 |
| Miscellaneous Facility Requirements | Lump Sum | 2.0 | 3.3 |
| Laterals in Right of Way | 4769 | 14.3 | 10.0 |
| On-Lot Lateral Costs | Lump Sum | 9.7[(2)] | Not Included |
| Road Restoration | Lump Sum | Assumed Included Above | Assumed Included Above |
| Land and Easement Acquisition | Lump Sum | Not Included | Not Included |
| Subcontracted Services | Lump Sum | Assumed Included Above | Assumed Included Above |
| TOTAL CONSTRUCTION COST | | $56.2 | $67.4 + On-Lot Lateral Costs |

Notes:
(1) Based on Engineer's Final Estimate and Review of Bid Tabs from Whitaker and Barnard Construction, dated February 24, 2005.
(2) Based on Final Project Report (Montgomery Watson Americas, March 2001).
(3) All costs are in April 2007 dollars, based on an ENR of 7879.
(4) Quantity does not include lateral in right-of-way listed separately.

Figure 3.1 shows a schematic of the gravity/low pressure collection system components. The following is a brief description of significant components of the system required for a comparative cost estimate.

*Gravity Sewers and Force Mains*

Gravity sewers and force mains are used to convey the wastewater from laterals (to each property) to the wastewater treatment facility. Approximately 230,000 linear feet of gravity sewers and force mains were included in the Tri-W Project design. Separate line items were provided for shoring/dewatering and laterals within the right-of-way (in contrast to the STEP/STEG estimate which was presented below prepared by the Ripley Pacific Team and estimated 254,000 linear feet for force mains AND laterals within the right-of-way).

Gravity sewers and force mains were designed to be PVC ranging in diameter from 8 to 18 inches. The pipes were an average of 8 feet deep, but were as deep as 30 feet in the Tri-W Project design.

*Laterals in Right of Way*

These costs include the pipe needed to stub out the collection system from the gravity sewer to the property line in front of each home. The pipe was designed as 4-inch PVC at an average depth of approximately 4 feet and was part of the community wide wastewater project.

*On-Lot Lateral Costs*

On-lot laterals will be 4-inch PVC pipelines that connect the laterals in the right-of-way to each individual home, business or complex. On-lot lateral costs were not included in the engineer's final estimate or bid tab estimates. While it is anticipated that these costs (and work) will be the responsibility of the individual homeowners, these costs were included in this report for comparison with the STEP/STEG alternative. The Final Project Report (Montgomery Watson Americas, March 2001) estimated the on-lot costs to be $9.7 million (April 2007 dollars).

As shown in Figure 3.1, it is anticipated that there will be three options for on-lot sewer lateral installation. Based on an analysis of lots in Los Osos, Table 3.2 shows a breakdown of on-lot installation options.

*Road Restoration*

The existing roads will be damaged in order to install the gravity sewer, force mains, and right-of-way laterals. The roads must be restored to original condition. Road restoration costs are assumed included in other line items (Gravity Sewers and Force Mains, Manholes, Laterals in Right-of-Way) for the final engineer's estimate and the bid tab values.

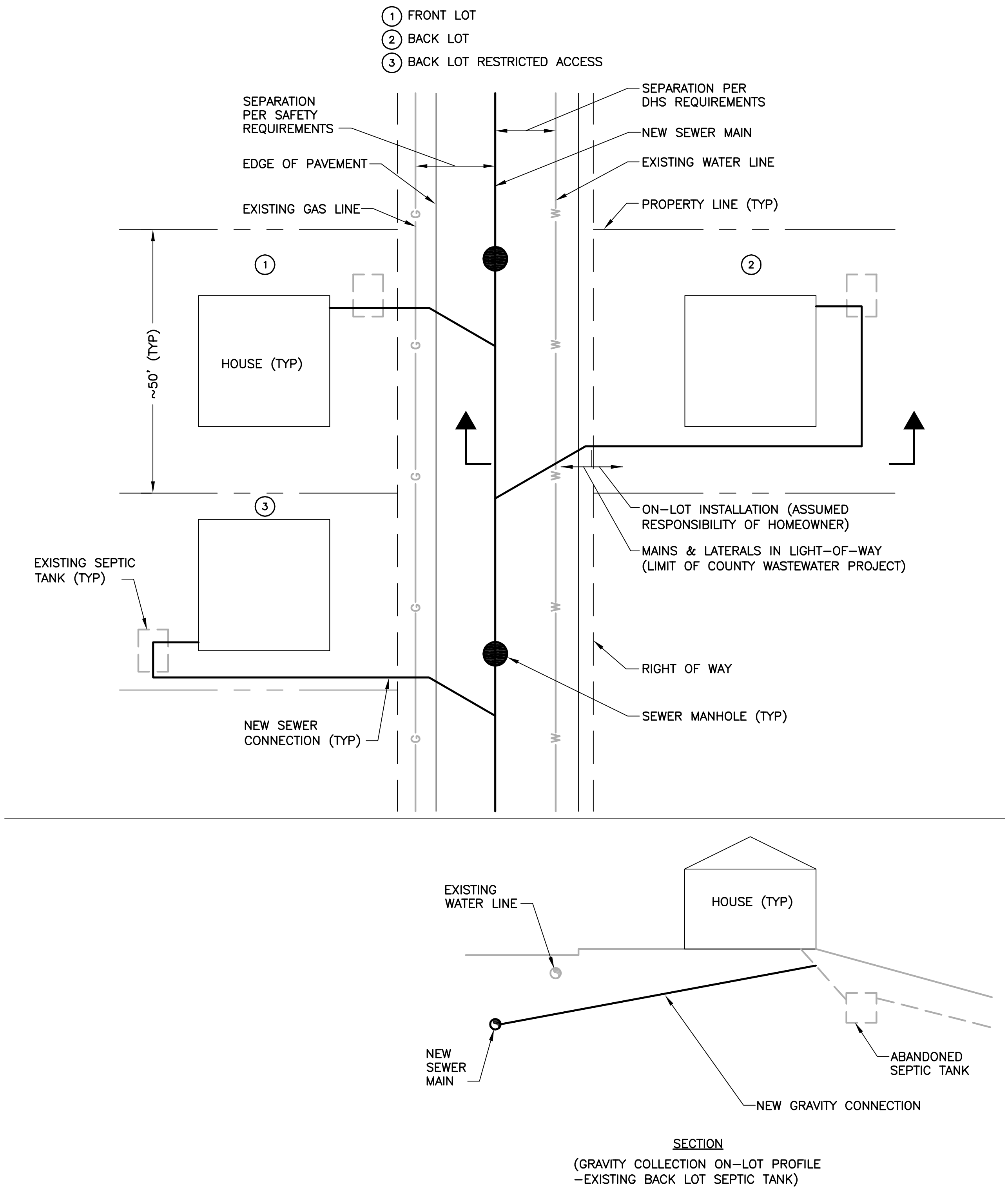



**Figure 3.1**
**GRAVITY COLLECTION**
**ON-LOT INSTALLATION OPTIONS**
**LOS OSOS WASTEWATER**
**PROJECT DEVELOPMENT**
San Luis Obispo County

**Table 3.2 On-Lot Installation Options for Gravity Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| On-Lot Installation Options for Gravity Collection System | Percent of Lots in Prohibition Zone Requiring Installation Option (%) |
|---|---|
| Front of Lot Lateral | 75 |
| Back of Lot Lateral | 5[1] |
| Back of Lot Lateral with Restricted Access to Back Yard | 20[2] |

Notes:
(1) 25 percent of the existing septic tanks are in the backyard. 20 percent of backyard installations are assumed to have access for heavy construction equipment.
(2) 25 percent of the existing septic tanks are in the back yard. 80 percent of these tanks are assumed to have limited access for heavy construction equipment due to the relatively small lot size, neighboring houses, fences, trees, etc.

#### 3.1.2.2 STEP/STEG Collection System

A STEP/STEG collection system was investigated as part of the Los Osos Wastewater Management Plan Update (Ripley Pacific Team, July 2006). Table 3.3 provides information on the estimate for STEP/STEG presented in the report for the prohibition zone. The estimate was approximately $56.2 million escalated to April 2007 dollars, and assumed conveyance to an out of town facility.

**Table 3.3 Estimate for STEP/STEG Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Ripley Estimate ($M)[1] |
|---|---|
| Mobilization/Demobilization/General Conditions | 2.2 |
| Force Mains and Laterals in Right-of-Way | 11.2 |
| On-Lot System Costs | 33.4 |
| Electrical Connection | Assumed Included Above |
| Odor Control | Assumed Included Above |
| Road Restoration | Assumed Included Above |
| Land and Easement Acquisition | Assumed No Additional Cost for STEP System |
| SUBTOTAL | $46.8 |
| Contingency (20%) | $9.4 |
| TOTAL CONSTRUCTION COST | $56.2 |

Note:
(1) Based on Ripley Pacific Team report “Los Osos Wastewater Management Plan Update” dated July 2006.

Figure 3.2 shows a schematic of the STEP/STEG collection system components. The following is a brief description of significant components of the system required for a comparative cost estimate.

*Force Mains and Laterals in Right-of-Way*

This item is the cost to install the main collection system piping in the public right-of-way. Horizontal directional drilling (HDD), a trenchless type of pipe installation that may be employed reasonably economically for small diameter piping, is the assumed installation method. This type of pipe installation method does not require that the street be disrupted except at certain access points for directional drilling.

Force mains (pressurized piping) are used to convey the wastewater from laterals (to each property) to the wastewater treatment facility. Approximately 254,000 linear feet of PVC force mains ranging in diameter from 2 to 10-inches are included. The pipes were assumed to be approximately 4 feet deep to avoid existing utilities and provide minimal cover.

This line item includes lateral piping within the right-of-way needed to stub out the collection system from the main piping to the property line in front of each home. The laterals are assumed to be 1-1/2-inch PVC at an average depth of approximately 4 feet.

Since the piping is relatively shallow and minimal access points are required, shoring and dewatering requirements are anticipated to be minimal. In addition, the pressurized piping eliminates the need for manholes, centralized pump stations, standby power facilities and miscellaneous facility requirements necessary for a gravity collection system.

*On-Lot System Costs*

On-lot system construction will include all of the work that will take place on private property. It will include abandoning or demolishing the existing septic tank, installation of a new septic tank, septic pump controls and alarm system, and connection to the lateral within the right-of-way. On-lot laterals are 1-1/2-inch PVC pipelines at a depth of approximately 4 feet.

As shown in Figure 3.2, there are four options for on-lot installation of a STEP/STEG system, which assume all septic tanks are replaced with STEP tanks located in the front of the lot as a County goal to facilitate operation and maintenance access.

.

**Range of Probable Costs**
The County has included anticipated permitting and funding requirements for on-lot system costs, including locating septic tanks in the front of the lot and separate electrical service for the STEP system, to bracket the range of probable costs. Depending on actual permit requirements of funding sources, every attempt will be made to minimize actual construction costs during due diligence and detailed design. However, bracketing the upper range of costs is critical so there are no surprises as the project proceeds.

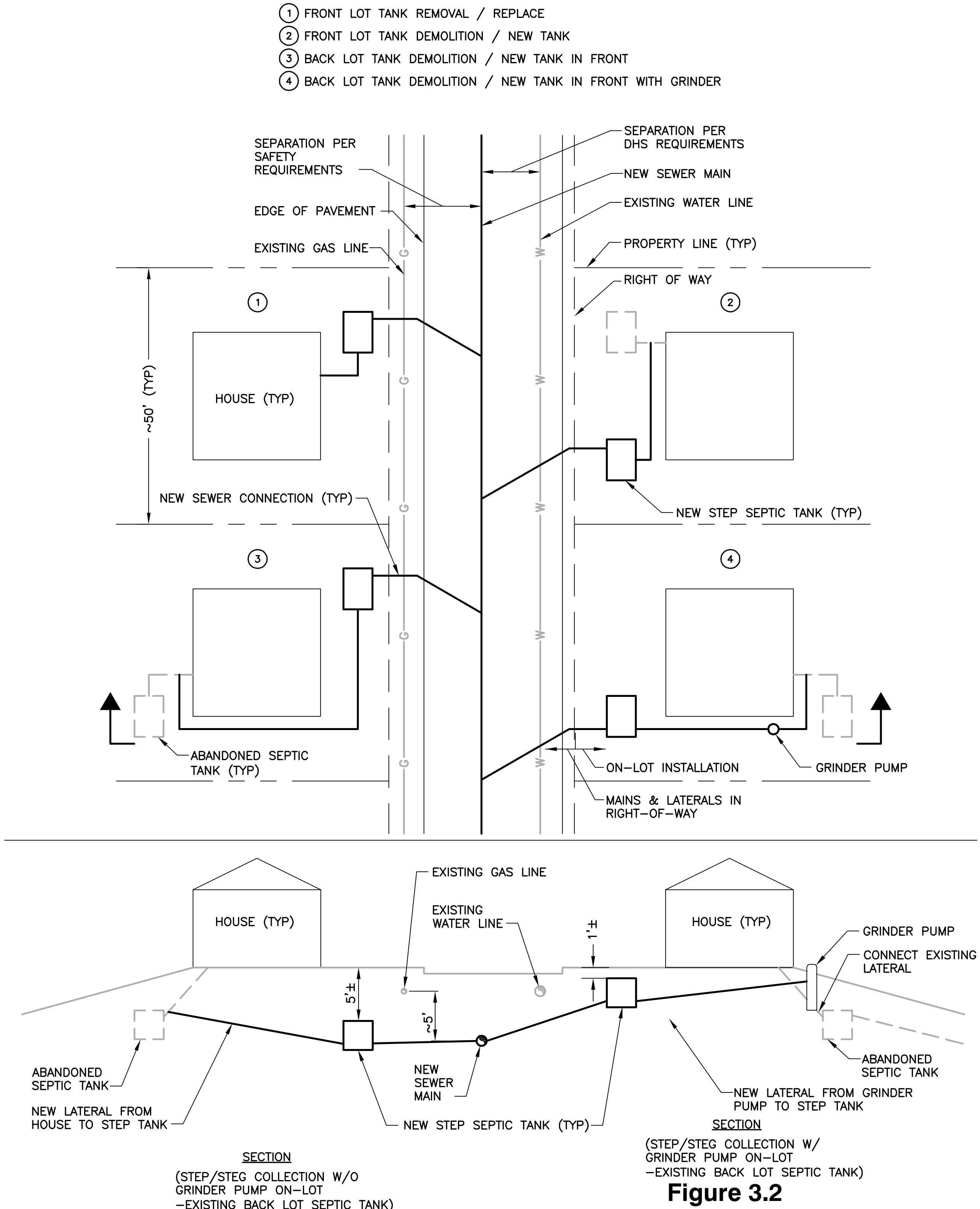



**Figure 3.2**
**STEP/STEG COLLECTION ON-LOT INSTALLATION OPTIONS**
**LOS OSOS WASTEWATER PROJECT DEVELOPMENT**
San Luis Obispo County

The STEP tanks are similar in size to conventional septic tanks at approximately 10 feet long and 5 feet in diameter and hold 1500 gallons. Based on an analysis of lots in Los Osos, Table 3.4 shows a breakdown of on-lot installation requirements.

**Table 3.4 On-Lot Installation Options for STEP/STEG Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| On-Lot Installation Options for STEP/STEG Collection System | Percent of Lots in Prohibition Zone Requiring Installation Option (%) |
|---|---|
| Front Lot Septic Tank Removal with Installation of STEP Tank In Same Place | 7.5(1) |
| Front Lot Septic Tank Abandonment with Installation of STEP Tank In New Front Lot Location | 67.5(2) |
| Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot | 20(3) |
| Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot with Grinder Pump | 5(4) |

Notes:
(1) Based on analysis showing 75% of existing tanks are in front lot and 10% of tanks can be removed (local contractor evaluation).
(2) Based on analysis showing 75% of existing tanks are in front lot and 90% of tanks should be demolished in place (local contractor evaluation).
(3) Based on analysis showing 25% of existing tanks are in back lot and 80% of tanks can be relocated to the front lot at a maximum depth of 10 feet without a grinder pump.
(4) Based on analysis showing 25% of existing tanks are in back lot and 20% of tanks require a grinder pump to locate the tanks in the front lot .

*Electrical Connection*

Each residence requiring a STEP system will require a new electrical connection to provide power to the new pump, controls and alarm system. Electrical connection costs were included in the Wastewater Management Plan Update (Ripley Pacific Team, July 2006), however, permitting and funding requirements for the State Revolving Fund program may necessitate separate electrical service for the STEP system instead of service from existing residential breaker panels if that funding source is pursued.

*Odor Control*

Odor control measures will be required at high points throughout the system where air within the piping is released to prevent air bubbles from forming. Odor control will consist of carbon media canisters that remove the odorous compounds such as hydrogen sulfide from the air as it passes through the media. The canisters and air release valves on the pressurized main lines would be enclosed in a small (approx. 3 by 4 by 4 feet) buried vault. STEP tanks would be vented to roof level, similar to existing septic tanks.

*Road Restoration*

As described above, the amount of road restoration required for trenchless pipe installation will be less than that required for conventional open cut methods. However, there will still be locations that require the removal of pavement to install the main piping and laterals within the right-of-way.

## 3.2 COST DEVELOPMENT

### 3.2.1 Assumed Construction Sequence

#### 3.2.1.1 <u>Gravity /Low Pressure Collection System</u>

Figure 3.3 shows the assumed construction sequence for a gravity/low pressure collection system. The common facilities such as the gravity sewers, force mains, pump stations and treatment plant are assumed be constructed and operational prior to construction of on-lot components and abandonment of the existing septic tank.

#### 3.2.1.2 <u>STEP/STEG Collection System</u>

Figure 3.4 shows the assumed construction sequence for septic tank removal with the installation of a STEP tank in the same place.

Figure 3.5 shows the assumed construction sequence for septic tank abandonment with installation of a STEP tank in a new front lot location.

### 3.2.2 Capital Cost

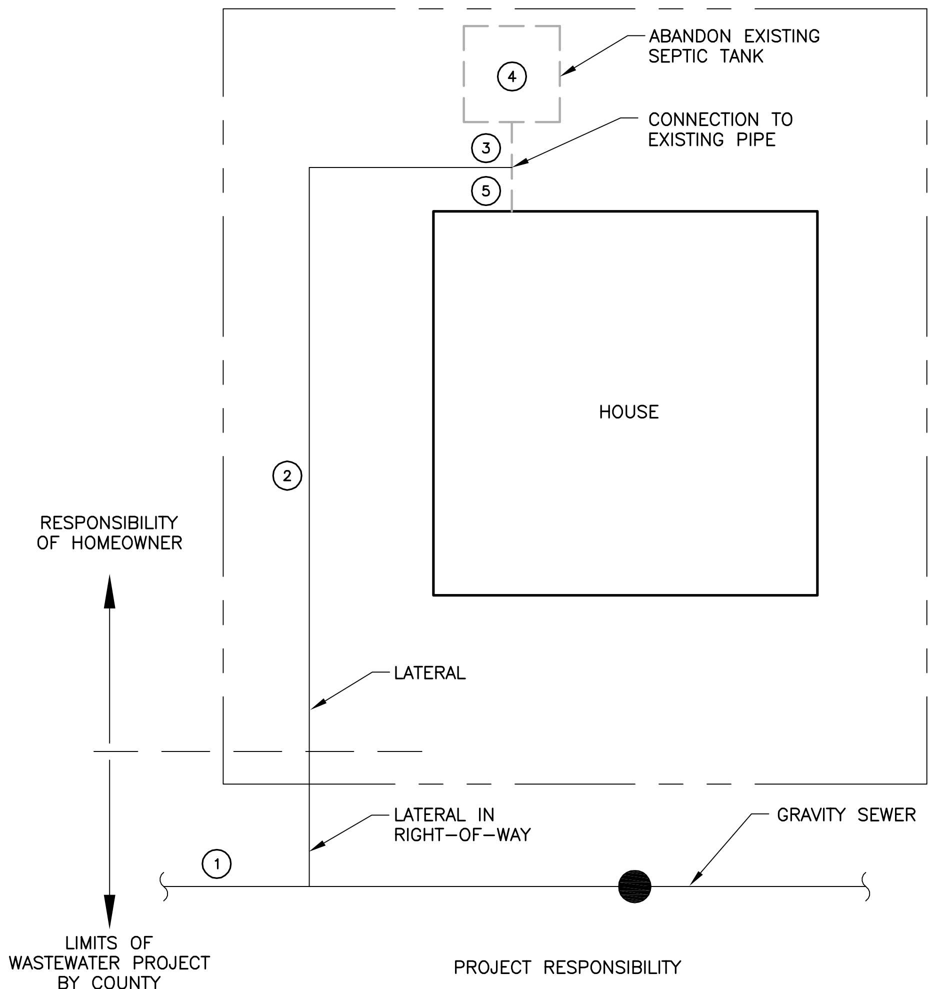
#### 3.2.2.1 <u>On-Lot Cost Development</u>

**Gravity/Low Pressure Collection System**

Based on the location of the existing septic tank, on-lot construction requirements are divided into one of the following three options:

- Back of Lot Lateral
- Back of Lot Lateral with Restricted Access to Backyard
- Front of Lot Lateral

The three options are shown in Figure 3.6. Tables 3.5 through 3.7 break down the major components for each option and the associated cost.




PROJECT RESPONSIBILITY

(1) INSTALL GRAVITY SEWERS, FORCE MAINS, MANHOLES, PUMP STATIONS, STANDBY POWER FACILITIES, LATERALS WITHIN RIGHT–OF–WAY AND TREATMENT FACILITY

HOMEOWNER RESPONSIBILITY

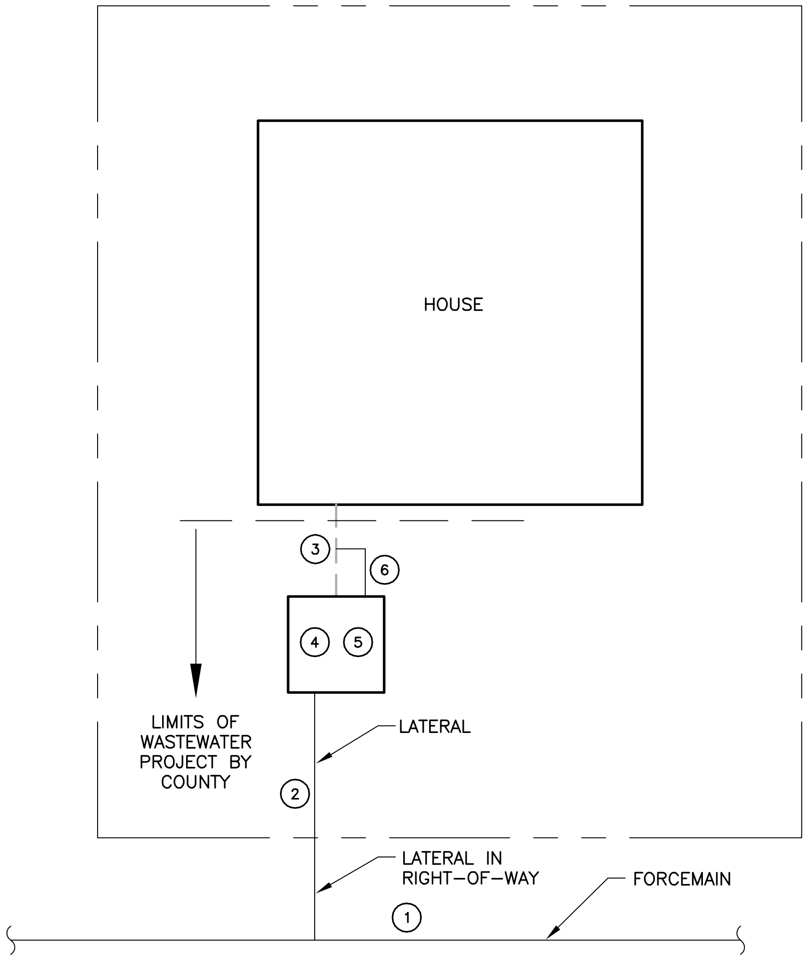
(2) INSTALL PIPE SLOPED FROM CURB TO LOCATION OF THE EXISTING TANK

(3) DISCONNECT OLD TANK FROM HOME AND PUMP SEPTAGE

(4) ABANDON EXISTING TANK

(5) CONNECT HOME TO GRAVITY PIPE

**Figure 3.3**
**GRAVITY COLLECTION CONSTRUCTION SEQUENCE**
**LOS OSOS WASTEWATER PROJECT DEVELOPMENT**
San Luis Obispo County

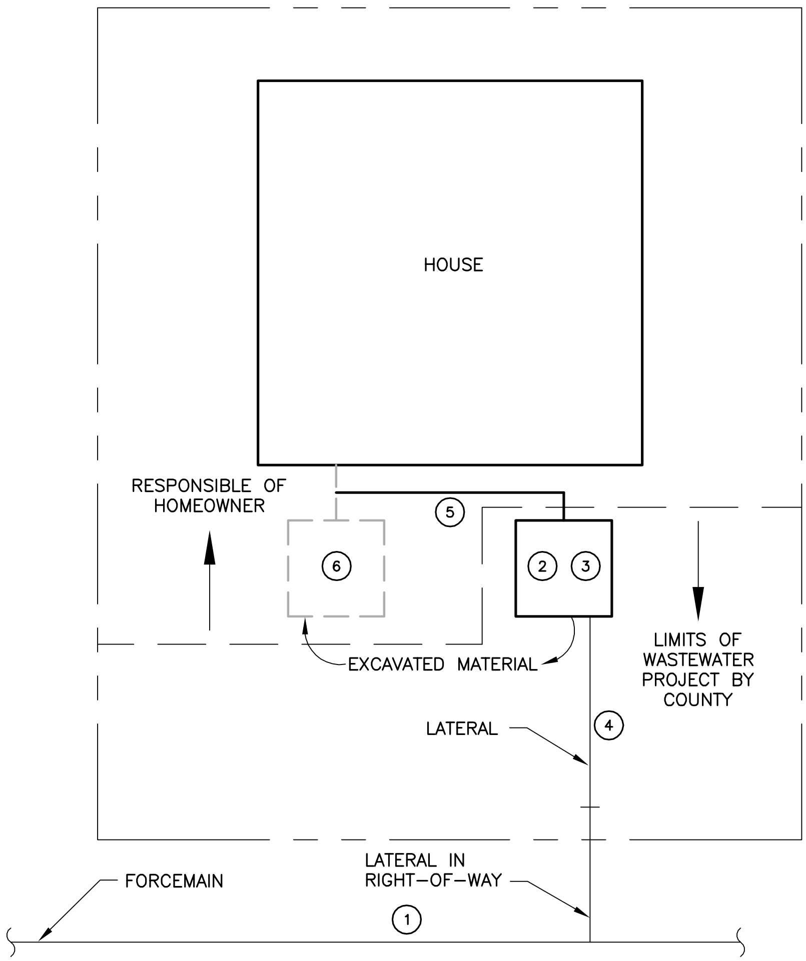



PROJECT RESPONSIBILITY

1. INSTALL FORCE MAINS, LATERALS WITHIN RIGHT-OF-WAY AND TREATMENT FACILITY
2. INSTALL PIPE FROM EDGE OF PROPERTY TO LOCATION OF THE EXISTING TANK
3. DISCONNECT EXISTING TANK FROM HOME AND PUMP SEPTAGE
4. REMOVE EXISTING TANK
5. INSTALL NEW TANK
6. CONNECT NEW TANK TO HOME AND EFFLUENT PIPE

**Figure 3.4**
**STEP/STEG COLLECTION TANK IN EXISTING LOCATION CONSTRUCTION SEQUENCE LOS OSOS WASTEWATER PROJECT DEVELOPMENT**
San Luis Obispo County

carollo engineers



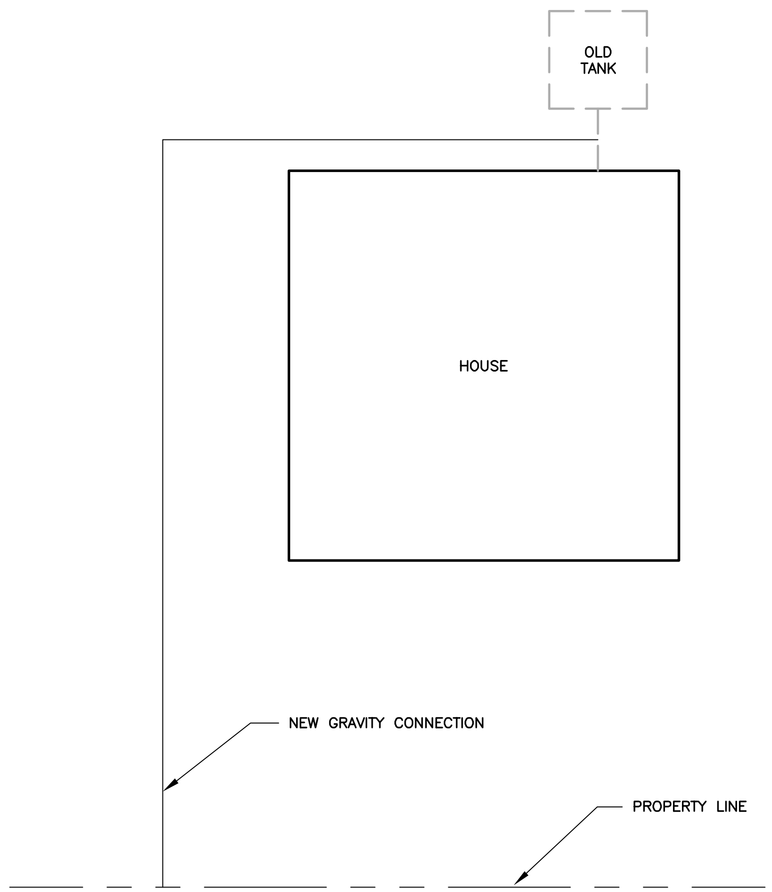

PROJECT RESPONSIBILITY

1. INSTALL FORCE MAINS, LATERALS WITHIN RIGHT-OF-WAY AND TREATMENT FACILITY
2. EXCAVATE FOR NEW SEPTIC TANK
3. INSTALL NEW SEPTIC TANK
4. INSTALL PIPE FROM NEW TANK TO EDGE OF PROPERTY

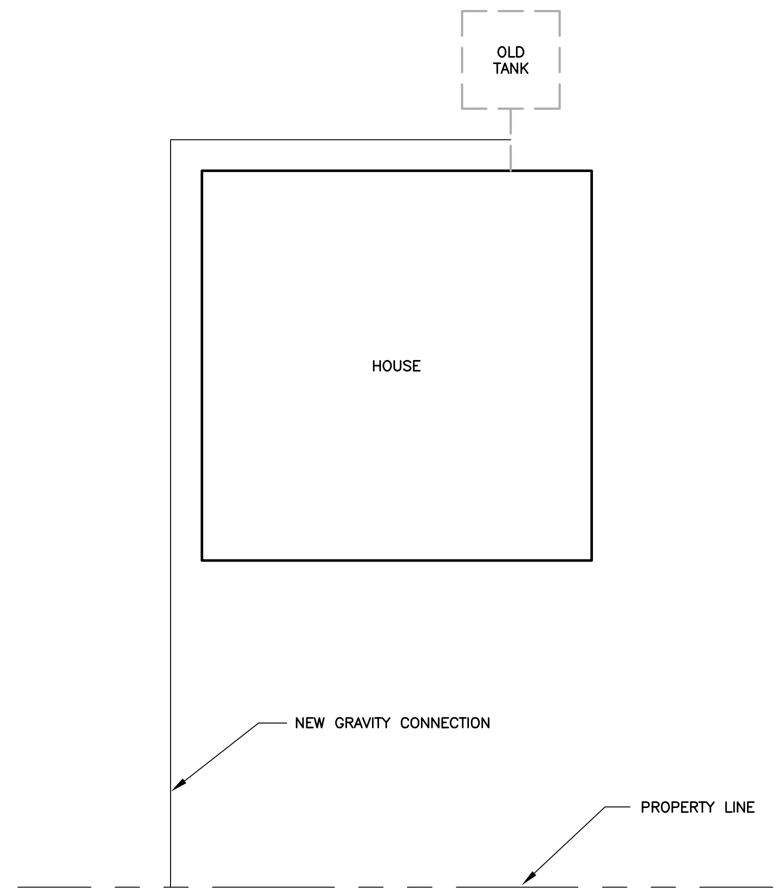
HOMEOWNER RESPONSIBILITY

5. INSTALL PIPE FROM HOME TO NEW TANK, DISCONNECT EXISTING TANK
6. BACKFILL EXISTING TANK WITH EXCAVATED MATERIAL FROM NEW TANK

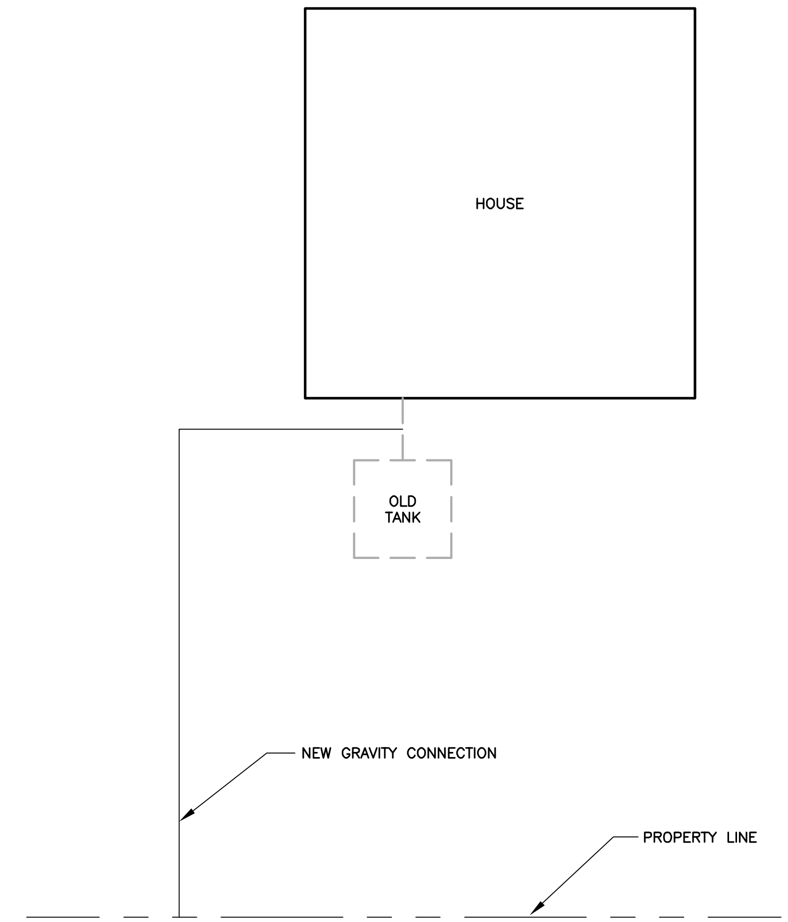
**Figure 3.5**
**STEP/STEG COLLECTION**
**NEW FRONT LOT LOCATION**
**CONSTRUCTION SEQUENCE**
**LOS OSOS WASTEWATER**
**PROJECT DEVELOPMENT**
San Luis Obispo County




BACK OF LOT LATERAL
(TABLE 3.5)




BACK OF LOT LATERAL
WITH RESTRICTED ACCESS
(TABLE 3.6)




FRONT OF LOT LATERAL
(TABLE 3.7)

NOTE
GRINDER PUMPS REQUIRED FOR LESS THEN 200 LOTS BASED ON PREVIOUS WORK.
THOSE LOTS ARE NOT SHOWN HERE. SEE TABLE 3.8 FOR GRINDER PUMP COSTS.

**Figure 3.6**
**THREE GRAVITY INSTALLATION OPTIONS**
**LOS OSOS WASTWATER PROJECT DEVELPMENT**
SAN LUIS OBISPO COUNTY

| **Table 3.5** | **Cost Estimate for Back of Lot Lateral<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** |
|---|---|
| **Item** | **Cost** |
| Abandon Existing Septic Tank | $300[1] |
| Sewer Lateral | $1,800[1,2] |
| Yard Restoration | $500 |
| TOTAL ON-LOT COST | $2,600 |

Notes:
(1) Based on estimate from local contractor.
(2) Based on lateral 80 feet long. Includes excavation, backfill and labor.

| **Table 3.6** | **Cost Estimate for Back of Lot Lateral with Restricted Access to Backyard<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** |
|---|---|
| **Item** | **Cost** |
| Abandon Existing Septic Tank | $300[1] |
| Sewer Lateral | $4,100[1,2] |
| Yard Restoration | $500 |
| TOTAL ON-LOT COST | $4,900 |

Notes:
(1) Based on estimate from local contractor.
(2) Based on lateral 80 feet long. Includes excavation, backfill and labor.

| **Table 3.7** | **Cost Estimate for Front of Lot Lateral<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** |
|---|---|
| **Item** | **Cost** |
| Abandon Existing Septic Tank | $300[1] |
| Sewer Lateral | $800[1,2] |
| Yard Restoration | $250 |
| TOTAL ON-LOT COST | $1,400 |

Notes:
(1) Based on estimate from local contractor.
(2) Based on lateral 30 feet long. Includes excavation, backfill and labor.

Table 3.8 summarizes the estimated cost for the entire system, using the percentages developed above of lots that fall into each of the three gravity options and the estimated cost for each option. This table also includes costs for low pressure system components included in the previous design.

**Table 3.8 Estimated Cost Summary for On-Lot Gravity/Low Pressure System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Option | Total Estimated Cost ($ M) (1) |
|---|---|
| Back of Lot Lateral | 0.6 |
| Back of Lot Lateral with Restricted Access to Backyard | 4.7 |
| Low Pressure System (Grinder Pumps)(2) | 0.6 |
| Front of Lot Lateral | 5.0 |
| TOTAL CONSTRUCTION COST | $10.9 |

Note:
(1) Based on 4,769 septic tanks in the Prohibition Zone, percent breakdown in Table 3.2 and on-lot costs developed in Tables 3.5, 3.6, and 3.7.
(2) Includes materials and installation of 200 grinder pumps based on previous design.

#### 3.2.2.2 Conveyance to Out-of-Town Treatment Facility

Table 3.9 provides the range of probable costs for conveyance from the Tri-W site to an out-of- town site near the cemetery site for a gravity/low pressure system. The estimated cost to construct is between $2.9 and $4.1 million.

#### 3.2.2.3 STEP/STEG Collection System

Based on the location and condition of the existing septic tank, on-lot construction requirements are divided into one of the four following options:

- Front Lot Septic Tank Removal with Installation of STEP Tank In Same Place.
- Front Lot Septic Tank Abandonment with Installation of STEP Tank In New Front Lot Location.
- Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot.
- Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot with Grinder Pump.

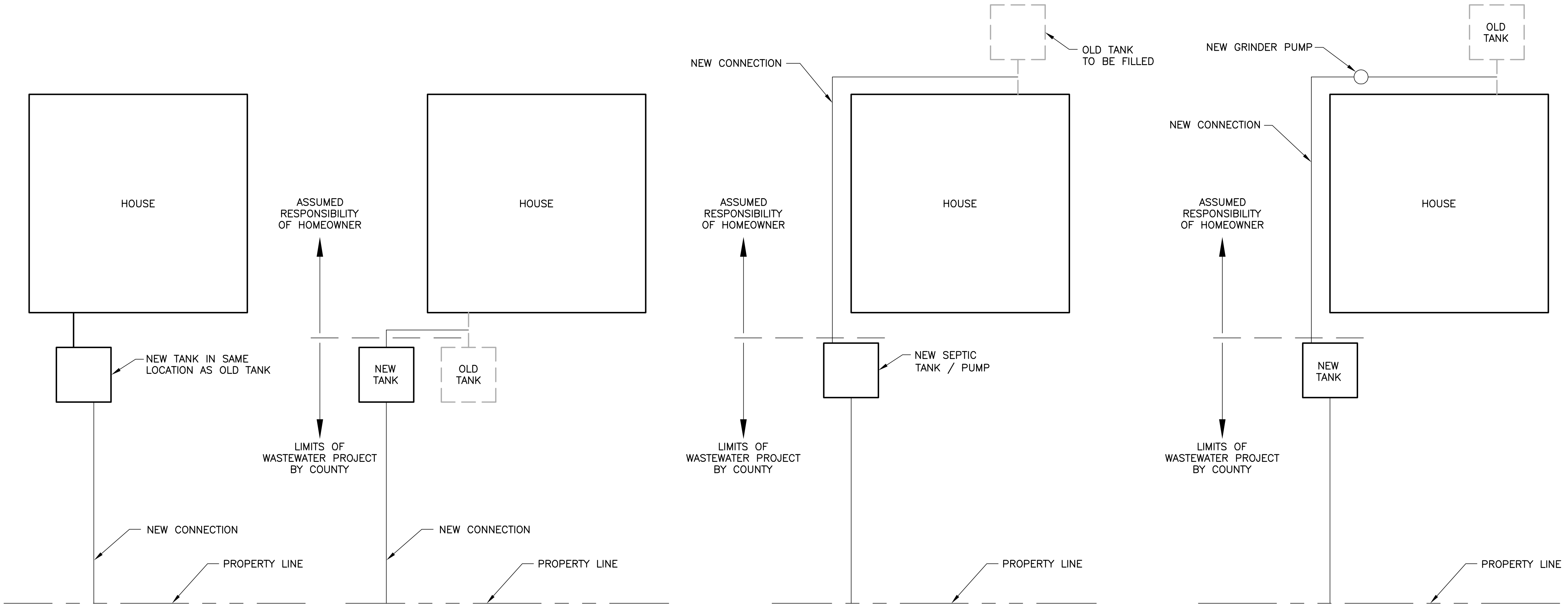
| **Table 3.9** | **Range of Probable Costs for Conveyance to Out of Town Treatment Facility<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** | | | |
|---|---|---|---|---|
| **Item** | **Quantity** | **Range of Probable Costs**<br>**Low ($M)** (1) | <br>**High ($M)**(1) | **Notes on Development of Range** |
| Pump Station at Tri-W Site (2) | Lump Sum | 0.6 | 0.8 | High estimate includes 30% contingency |
| Standby Power Facility (2) | Lump Sum | 0.4 | 0.6 | High estimate includes 30% contingency |
| Pump Station Odor Control (3) | Lump Sum | 0.1 | 0.2 | High estimate includes 30% contingency |
| Force Main | 12,500 LF | 1.5 | 2.0 | High estimate includes microtunneling of 500 LF under Los Osos Creek |
| Subtotal | | $2.6 | $3.6 | |
| Overhead and Profit (15%)(4) | | $0.2 | $0.3 | |
| Subtotal | | $2.8 | $3.9 | |
| Sales Tax (8%)(5) | | $0.1 | $0.2 | |
| TOTAL CONSTRUCTION COST (6) | | $2.9 | $4.1 | |

Notes:
(1) All costs in April 2007 dollars, based on an ENR of 7879.
(2) Based on Barnard Construction bid tab estimate (April 2005) escalated at 5% per year to April 2007. Assumed to include Overhead and Profit and sales tax.
(3) Based on Ripley Pacific Team estimate in 2004 dollars escalated at 5% per year to April 2007.
(4) Overhead and Profit on Pump Station Odor Control and Force Main only. Assumed to be included in bid tab estimates for other line items.
(5) Sales tax included on materials for Pump Station Odor Control and Force Main only. Assumed to be included in bid tab estimates for other line items.
(6) Land and Easement acquisition costs not included.

The four options are shown in Figure 3.7. The Project will install new STEP/STEG systems. Homeowner will be responsible to go from house to inlet of new STEP/STEG tank.

Tables 3.10 through 3.13 break down the major components for each option and the associated cost. Table 3.14 summarizes the estimated cost for the on-lot system costs, using the percentages provided above of lots that fall into each of the four STEP options, and the estimated cost for each option.

Tables 3.15 and 3.16 provide the costs to connect each new STEP tank to the existing electrical system. Table 3.15 provides a range of base costs for connection to the existing residential electrical system. Table 3.16 provides a range of additional costs that the homeowner may incur to provide separate electrical service to satisfy permitting and funding requirements if SRF funding stipulates this requirement and is pursued. The costs are averages based on a memorandum from Thoma Electric dated May 1, 2007. This memorandum is included in Appendix B.




FRONT LOT SEPTIC TANK REMOVAL W/INSTALLATION OF STEP TANK IN SAME PLACE (TABLE 3.10)

FRONT LOT SEPTIC TANK ABANDONMENT W/INSTALLATION OF STEP TANK IN NEW FRONT LOT LOCATION (TABLE 3.11)

BACK LOT SEPTIC TANK ABANDONMENT W/INSTALLATION OF STEP TANK IN FRONT LOT (TABLE 3.12)

BACK LOT SEPTIC TANK ABANDONMENT W/INSTALLATION OF STEP TANK IN FRONT LOT W/GRINDER PUMP (TABLE 3.13)

**Figure 3.7**
**FOUR STEP/STEG COLLECTION OPTION**
**LOS OSOS WASTEWATER**
**PROJECT DEVELOPMENT**
SAN LUIS OBISPO COUNTY

**Table 3.10 Cost Estimate for Front Lot Septic Tank Removal with Installation of STEP Tank In Same Place**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Cost |
|---|---|
| Project Costs | |
| Demolish Existing Septic Tank | $500[1] |
| STEP Septic Tank | $2,000[2] |
| Pump and Controls | $2,200[2] |
| Sewer Lateral | $500[1,3] |
| Assumed Homeowner Responsibility | |
| Yard Restoration | $500 |
| TOTAL ON-LOT COST | $5,700 |

Notes:
(1) Based on estimate from local contractor.
(2) Based on Orenco estimate. Pump and controls include remote telemetry to central operation facility.
(3) Based on lateral 30 feet long. Includes excavation, backfill and labor.

**Table 3.11 Cost Estimate for Front Lot Septic Tank Abandonment with Installation of STEP Tank In New Front Lot Location**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Cost |
|---|---|
| Project Costs | |
| STEP Septic Tank | $2,000[1] |
| Pump and Controls | $2,200[1] |
| Sewer Lateral | $500[2,3] |
| Assumed Homeowner Responsibility | |
| Abandon Existing Septic Tank | $300[2] |
| Sewer Lateral | $200[2,4] |
| Yard Restoration | $500 |
| TOTAL ON-LOT COST | $5,700 |

Notes:
(1) Based on Orenco estimate. Pump and controls include remote telemetry to central operation facility.
(2) Based on estimate from local contractor.
(3) Based on lateral 20 feet long. Includes excavation, backfill and labor. Excavation for STEP septic tank included.
(4) Based on lateral 10 feet long. Included excavation, backfill and labor.

**Table 3.12 Cost Estimate for Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Cost |
|---|---|
| Project Costs | |
| STEP Septic Tank | $2,000(1) |
| Pump and Controls | $2,200(1) |
| Sewer Lateral | $1,000(2,3) |
| Limited Access to Backyard | $300 |
| Assumed Homeowner Responsibility | |
| Abandon Existing Septic Tank | $300(1) |
| Yard Restoration | $750 |
| Sewer Lateral | $600(2,4) |
| TOTAL ON-LOT COST | $7,150 |

Notes:
(1) Based on Orenco estimate. Pump and controls include remote telemetry to central operation facility.
(2) Based on estimate from local contractor.
(3) Based on lateral 40 feet long. Includes excavation, backfill and labor. Excavation for 5 feet deep STEP septic tank included.
(4) Based on lateral 40 feet long. Included excavation, backfill and labor.

**Table 3.13 Cost Estimate for Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot with Grinder Pump**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Cost |
|---|---|
| Project Costs | |
| STEP Septic Tank | $2,000(1) |
| Pump and Controls | $2,200(1) |
| Sewer Lateral | $500(3,4) |
| Assumed Homeowner Responsibility | |
| Abandon Existing Septic Tank | $300(3) |
| Grinder Pump | $2,800(2) |
| Yard Restoration | $750 |
| Sewer Lateral | $700(3,5) |
| TOTAL ON-LOT COST | $9,250 |

Notes:
(1) Based on Orenco estimate. Pump and controls include remote telemetry to central operation facility.
(2) Based on estimate from Environment One.
(3) Based on estimate from local contractor.
(4) Based on lateral 40 feet long. Includes excavation, STEP tank excavation, backfill and labor.
(5) Based on lateral 40 feet long. Includes excavation, backfill and labor.

**Table 3.14 Summary of Estimated Cost for STEP On-Lot System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Option | Project Cost ($ M)[1] | Homeowner Cost ($ M)[1] | Total Estimated Cost ($ M)[1,2] |
|---|---|---|---|
| Front Lot Septic Tank Removal with Installation of STEP Tank In Same Place | 1.8 | 0.2 | 2.0 |
| Front Lot Septic Tank Abandonment with Installation of STEP Tank In New Front Lot Location | 15.2 | 3.2 | 18.4 |
| Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot | 5.3 | 1.6 | 6.9 |
| Back Lot Septic Tank Abandonment with Installation of STEP Tank In Front Lot with Grinder Pump | 1.2 | 1.1 | 2.3 |
| TOTAL CONSTRUCTION COST | $23.5 | $6.1 | $29.6 |

Note:
(1) Based on 4,769 septic tanks in the Prohibition Zone, percent breakdown in Table 3.4 and on-lot costs developed in Table 3.10 through 3.13.
(2) Electrical connection costs not included.

**Table 3.15 STEP Electrical Connection Base Cost**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Option | Low[1] | High[1] |
|---|---|---|
| New Sub-Panel or Modification to Existing Panel[2] | $800 | $1,300 |
| Connection Between Home and STEP Tank | $1,100[3] | $1,700[4] |
| TOTAL BASE COST PER CONNECTION | $1,900 | $3,000 |

Note:
(1) Costs from Electrical System Evaluation Memorandum (Thoma Electric, May 2007).
(2) Includes an average service upgrade of $5,000 for 5% of homes.
(3) Based on 40 feet connection between sub-panel and STEP Tank.
(4) Based on 60 feet connection between sub-panel and STEP Tank.

| Table 3.16 | STEP Electrical Connection Additional Costs for Separate Electrical Service<br>Los Osos Wastewater Project Development<br>San Luis Obispo County | |
|---|---|---|
| **Addition** | **Low[(1)]** | **High[(1)]** |
| Connection with PG&E Overhead or Underground Power Lines | $4,700[(2)] | $7,300[(3)] |
| Driveway Crossing | $250[(4)] | $250[(4)] |
| Hardscape[(5)] | $0 | $500 |
| TOTAL COST PER CONNECTION | $4,950 | $8,050 |
| BASE COST PER CONNECTION[(6)] | $1,900 | $3,000 |
| SPERATE ELECTRICAL SERVICE COST PREMIUM PER CONNECTION[(7)] | $3050 | $5,050 |

Note:
(1) Costs from Electrical System Evaluation Memorandum (Thoma Electric, May 2007).
(2) Based on 80% of homes connected via overhead service, 10% via underground 100 amp service and 10% via underground 200 amp service. Includes average service upgrade of $5,000 to 5% of homes.
(3) Based on 60% of homes connected via overhead service, 20% via underground 100 amp service and 20% via underground 200 amp service. Includes average service upgrade of $5,000 to 5% of homes.
(4) Installation of electrical buried line from sub-panel to STEP tank assumed to cross driveway. Based on 4 to 5 crossings per day, average cost, for 50% of homes.
(5) Replace/Repair of fences, retaining walls, etc.
(6) See Table 3.15.
(7) Difference between the Total Cost Per Connection and Base Cost Per Connection.

#### 3.2.2.4 Gravity/Low Pressure Collection System

Table 3.17 shows the range of probable costs for the previously designed gravity/low pressure collection system based on development of on-lot lateral costs presented above and independent estimates of significant components such as gravity sewers and force mains with Carollo Engineer's Unit Price Catalog. The estimated range of costs for the conveyance system is between $82.2 and $89.6 million.

#### 3.2.2.5 STEP/STEG Collection System

Table 3.18 shows the range of probable costs for a STEP/STEG collection system based on development of on-lot lateral costs and electrical connections presented above. The estimated range of costs for the conveyance system is between $65.0 and $105.5 million.

**Table 3.17 Range of Probable Costs for Gravity/Low Pressure Collection System
Los Osos Wastewater Project Development
San Luis Obispo County**

| Item [(2)] | Range of Probable Costs Low ($M)[(1)] | Range of Probable Costs High($M) [(1)] | Notes on Development of Range |
|---|---|---|---|
| Mobilization/Demobilization/ General Conditions | 3.7 | 4.0 | Based on 5% of Construction Cost Subtotal |
| COMMON FACILITIES | | | |
| Gravity Sewers and Force Mains | 27.8 | 30.6 | Low estimate based on Carollo Engineer's Unit Price Catalog with 15% contractor overhead and profit and 8% sales tax. High estimate includes 10% contingency due to final design level. |
| Manholes | 4.3 | 4.7 | Low estimate based on Carollo Engineer's Unit Price Catalog with 15% contractor overhead and profit and 8% sales tax. High estimate includes 10% contingency due to final design level. |
| Shoring and Dewatering | 4.8 | 5.3 | Low estimate based on Carollo Engineer's Unit Price Catalog with 15% contractor overhead and profit and 8% sales tax. High estimate includes 10% contingency due to final design level. |
| Duplex Pump Station | 2.6 | 2.6 | Based on Bid Tab values. |
| Triplex Pump Station | 1.2 | 1.2 | Based on Bid Tab values. |
| Pocket Pump Station | 2.4 | 2.4 | Based on Bid Tab values. |
| Standby Power Facility | 2.5 | 2.5 | Based on Bid Tab values. |
| Miscellaneous Facility Requirements | 3.3 | 3.3 | Based on Bid Tab values. |
| Laterals in Right of Way | 8.8 | 9.7 | Low estimate based on Carollo Engineer's Unit Price Catalog with 15% contractor overhead and profit and 8% sales tax. High estimate includes 10% contingency due to final design level. |
| Road Restoration | 5.2 | 5.2 | Based on bid assessment by the Wallace Group, March 2005 |
| Land and Easement Acquisition | Assumed No Additional Cost [(3)] | | |

**Table 3.17 Range of Probable Costs for Gravity/Low Pressure Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item [2] | Range of Probable Costs Low ($M)[1] | Range of Probable Costs High($M) [1] | Notes on Development of Range |
|---|---|---|---|
| ON-LOT FACILITIES | | | |
| Project Facilities | 0.0 | 0.0 | All on-lot costs assumed to be bourne by the individual homeowners for gravity/low pressure systems |
| Homeowner Facilities | 12.6 | 13.9 | Based on on-lot options and cost development information presented above. Includes 15% contractor overhead and profit and 8% sales tax. High estimate includes 10% contingency. |
| Overhead and Profit (15%) | Included Above [4] | Included Above [4] | |
| Subtotal | $79.3 | $85.5 | |
| Sales Tax (8%) | Included Above [4] | Included Above [4] | |
| Conveyance to Out-of-Town Treatment Facility | 2.9 | 4.1 | |
| TOTAL CONSTRUCTION COST | $82.2 | $89.6 | |

Notes:
(1) All costs in April 2007 dollars, based on an ENR of 7879.
(2) Prohibition zone lots only - 4,769 connections.
(3) Land and easement acquisition assumed to be sunk cost as part of previous Tri-W project.
(4) Contractor overhead and profit and sales tax assumed included in bid tab values. Where Unit Price Catalog estimates are used, contractor overhead and profit (15%) and sales tax (8%) are included in the individual line items. (Sales tax included in materials only.)

**Table 3.18 Range of Probable Costs for STEP/STEG Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item [2] | Range of Probable Costs | | Notes on Development of Range |
|---|---|---|---|
| | Low ($M) [1] | High ($M) [1] | |
| Mobilization/Demobilization /General Conditions | 2.6 | 3.2 | Based on 5% of Construction Cost Subtotal. |
| COMMON FACILITIES | | | |
| Force Mains and Laterals in Right-of-Way | 11.7 | 15.2 | Low estimate based on Los Osos Wastewater Management Plan Update (Ripley 2006) and installation costs from Tidwell. High estimate includes 30% contingency due to conceptual design level. |
| Odor Control | 0.1 | 0.3 | Low and High estimates based on 100 and 500 air release valves respectively at $500 each. |
| Road Restoration | 1.3 | 2.6 | Low and High estimates based on 25% and 50% of the gravity system requirements, respectively, due to estimated reduction in pavement disturbance. |
| Land and Easement Acquisition | Assumed No Additional Cost[3] | Assumed No Additional Cost[3] | |
| ON LOT FACILITIES | | | |
| Project Facilities | 23.5 | 25.8 | Based on on-lot options and cost development information presented above. High estimate includes 10% contingency similar to gravity system. |
| Homeowner Facilities | 6.1 | 6.7 | Based on on-lot options and cost development information presented above. High estimate includes 10% contingency similar to gravity system. |
| Electrical Connection | 9.1 | 14.3 | Low and High estimates based on $1,900 and $3,000 per connection as presented in Table 3.15 for 4769 Prohibition Zone lots. |
| Subtotal | $54.4 | $68.1 | |
| Overhead and Profit (15%) | $8.1 | $10.2 | |
| Subtotal | $62.3 | $78.3 | |
| Sales Tax (8%)[4] | $2.5 | $3.1 | |
| TOTAL CONSTRUCTION COST WITH BASE ELECTRICAL CONNECTION | $65.0 | $81.4 | |
| Separate Electrical Service Premium | $14.5 | $24.1 | |
| TOTAL CONSTRUCTION WITH SEPARATE ELECTRICAL SERVICE PREMIUM | $79.5 | $105.5 | |

Notes:
(1) All costs in April 2007 dollars, based on an ENR of 7879.
(2) Prohibition Zone lots only - 4769 connections.
(3) Land and easement acquisition assumed to be sunk cost as part of the previous Tri-W project.
(4) Sales Tax included on materials only.

### 3.2.3 O&M Cost

#### 3.2.3.1 Gravity Collection System

Table 3.19 shows the estimated O&M costs for a gravity collection system. The estimated O&M includes labor, power, and equipment maintenance. The Basis of Cost Evaluation Technical Memorandum is included in Appendix C.

**Table 3.19 Estimated O&M Costs for Gravity Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Units | Quantity | Unit Price ($) | Annual O&M ($) |
|---|---|---|---|---|
| Labor | Hrs/year | 4,160[(1)] | 40[(2)] | 170,000 |
| Power | Kwh/year | 500,000[(3)] | 0.12[(2)] | 60,000 |
| Equipment Maintenance/Replacement | %/year | 2 | Pump Station Power Facility and Misc Facility Requirements Construction Cost | 250,000 |
| TOTAL O&M COST[(4)] | | | | $480,000 |

Notes:
(1) Based on 2 full-time employees and 2,080 hours per year.
(2) From Basis of Cost Evaluation Technical Memorandum.
(3) Based on energy required to convey 1.4 mgd to an out-of-town treatment facility.
(4) Septic hauling costs for homes outside of the Prohibition Zone are not included.

#### 3.2.3.2 STEP/STEG Collection System

Table 3.20 shows the estimated O&M costs for a STEP collection system.

## 3.3 ENVIRONMENTAL/PERMITTING CONSIDERATIONS

Collection system analysis is for two types; conventional gravity and STEP/STEG. Both collection systems include over 45 miles of pipelines in most streets and approximately 5,000 lateral lines to collected properties. Gravity also includes pump/lift stations, and power standby facilities. Both systems require abandonment of existing septic systems. STEP/STEG includes installation of new septic systems at each collected property. The environmental issues are divided between the two systems.

### 3.3.1 Gravity Collection System Considerations

- Roadway disruptions during construction for up to two weeks for each block requiring sewer mains. Traffic is rerouted and access to individual homes is constrained. Careful noticing will be required.

**Table 3.20 Estimated O&M Costs for STEP Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Units | Quantity | Unit Price ($) | Annual O&M ($) |
|---|---|---|---|---|
| Labor | Hrs/year | 5,200[1] | 40[3] | 210,000 |
| Power | kWh/year | 425,000[4] | 0.12[3] | 50,000 |
| Electrical Maintenance/Replacement | %/year | 1 | Electrical Connection Construction Costs | 90,000 |
| Pump/Controls Maintenance/Replacement | Pumps/year | 700[5] | 400[6] | 280,000 |
| Odor Control Maintenance/Replacement | %/year | 20 | Odor Control Construction Costs | 20,000 |
| Septic Hauling[7] | Tanks/year | 950[8] | 150[2] | 140,000 |
| TOTAL O&M COST | | | | ~$790,000 |

Notes:
(1) Based on 2.5 full-time employees from Charlotte County Utility Authority, Florida, Olympia and other case studies contacted for Rough Screen Analysis. FTE based on 2,080 hours per year.
(2) Based on 1.5 full-time employees at $40/hour and $150,000 for septic hauling truck replaced every 10 years.
(3) From Basis of Cost Evaluation Technical Memorandum.
(4) Based on energy required to convey 1.2 mgd to an out-of-town treatment facility.
(5) Assumes pump replacement every 7 years.
(6) Based on pump cost provided by Orenco.
(7) Septic hauling costs for homes outside of the Prohibition Zone are not included.
(8) Based on anticipated RWQCB requirement for STEP tank pumping frequency of once every 5 years.

- Dewatering is required in low-lying areas. This water may require treatment or other special handling.
- Proximity to wetlands in some areas requires special Best Management Practices (BMP) to reduce the amount of sedimentation.
- Archaeological resources are located throughout the community and will require pipeline route relocation, or possible reburials.

- Monitoring for, and relocation of snails will be required in some areas of the community, to be determined by monitoring.
- Lateral installations will be close to some areas of wetlands, possibly requiring special permitting and mitigation. Laterals will have some impacts on landscaping and native habitat.
- Septic systems will require removal, abandonment or refitting for use as stormwater drains at each property with all associated impacts.
- Pump stations and power standby buildings will have visual effects and other issues depending upon location.
- Small amount of collection system will traverse native habitat requiring snail relocation and plant restoration.
- Odors will be released at pump stations and pocket pump stations and may require treatment.
- If the treatment plant is located east of Los Osos Creek, all of the collected untreated wastewater, and possibly some of the treated effluent will need to cross over or under the creek.

### 3.3.2 STEP/STEG Considerations

- Limited dewatering is required in low-lying areas. This water may require treatment or other special handling.
- Proximity to wetlands in some areas requires special Best Management Practices (BMP) to reduce the amount of sedimentation.
- Archaeological resources are located throughout the community and will require pipeline route relocation, or possible reburials.
- Monitoring for, and relocation of snails will be required in some areas of the community, to be determined by monitoring.
- Lateral installations will be close to some areas of wetlands, possibly requiring special permitting and mitigation. Laterals will have some impacts on landscaping and native habitat.
- Septic systems will require removal, abandonment or refitting for use as stormwater drains at each property with all associated impacts.
- Pump stations and power standby buildings will have visual effects and other issues depending upon location.
- Odors will be released at high points where vacuum/air release valves are required and may require treatment.

- If the treatment plant is located east of Los Osos Creek, all of the collected untreated wastewater, and possibly some of the treated effluent will need to cross over or under the creek.
- Roadway impacts are less due to the reduced amount of excavation required for main installation. The same considerations for snails, wetlands and dewatering will be required. Archaeological impacts will occur, but determination of extent will be made complicated by subsurface installation method.
- New septic systems will be required on every collected property. Greater area of construction disturbance will occur on private properties. Greater likelihood of existing septic tank removal required given the small lot width of most properties.
- STEP/STEG requires air release valves at high points in the collection system. These are known sources of odors and therefore must be mitigated.

## 3.4 SUMMARY OF ALTERNATIVES

### 3.4.1 Capital Cost Summary for Alternatives

The conventional gravity collection system probable cost ranges from $82.2 and $89.6 million, including conveyance to an out-of-town facility. The STEP collection system has a cost range of $65.0 to $105.5 million, including conveyance to an out-of-town facility. These estimates include design contingencies, contractor overhead and profit, and sales tax for comparison to the baseline bid tab values. Project costs, including design, construction management, legal and administrative, are provided in Chapter 7 for the complete viable project alternatives.

### 3.4.2 O&M Cost Summary for Alternatives

The conventional gravity collection system has been estimated to have an annual O&M cost of approximately $480,000. The STEP collection system has been estimated to have an annual O&M cost of $790,000.

### 3.4.3 Potential Considerations for Alternative Selection

A potential consideration for alternative selection is design time and cost. The gravity collection system has been designed and permitted for construction. This means that construction can begin as soon as a contractor is selected.

The STEP/STEG collection system, on the other hand, has not been designed. This will add additional cost and time for this alternative.

The various components that are to be installed downstream of the collection system (i.e. the treatment facility and biosolids handling equipment) will be affected by the type of collection system chosen. The treatment and solids treatment chapters detail how the different collection systems impact the sizes and costs of the facilities.

# TREATMENT TECHNOLOGY ALTERNATIVES

## 4.1 TREATMENT TECHNOLOGY OVERVIEW

### 4.1.1 Rough Screening Alternatives

This chapter describes and compares potential treatment processes for the Los Osos community wastewater project. The Potential Viable Project Alternatives Rough Screening Analysis (Carollo, March 2007) recommended six treatment alternatives for further evaluation.

The potentially viable treatment processes selected for detailed evaluation were:

- Extended Aeration Modified Ludzak-Ettinger (MLE)
- BIOLAC® Wastewater Treatment Process
- Sequencing Batch Reactor (SBR)
- Oxidation Ditch
- Trickling Filters
- Partially Mixed Facultative Ponds
- Membrane Bio-Reactor (MBR) - Tri-W Project only

A brief description and process schematic is provided below for each of the potentially viable treatment alternatives.

As indicated in the Rough Screening Analysis (Carollo, March 2007), an MBR system is viewed as the only treatment alternative that is urban compatible. MBRs are generally not the low cost alternative where land and urban mitigation are not project drivers. Therefore, MBR technology is viewed as the appropriate choice for the Tri-W Project, but will not be considered for development of other viable project alternatives.

MBRs provide high quality effluent meeting Title 22 requirements for reuse and facilitate implementation of future advanced treatment processes. The potentially viable treatment processes examined in this chapter will require additional tertiary treatment processes to meet Title 22 reuse requirements or as preparation for certain processes such as reverse osmosis, if required to meet future water quality regulations.

### 4.1.2 Extended Aeration MLE

Extended aeration MLE is an activated sludge system with anoxic and aerobic zones in an aeration basin for biological treatment of the wastewater. A flow schematic for an extended aeration MLE system is shown in Figure 4.1.

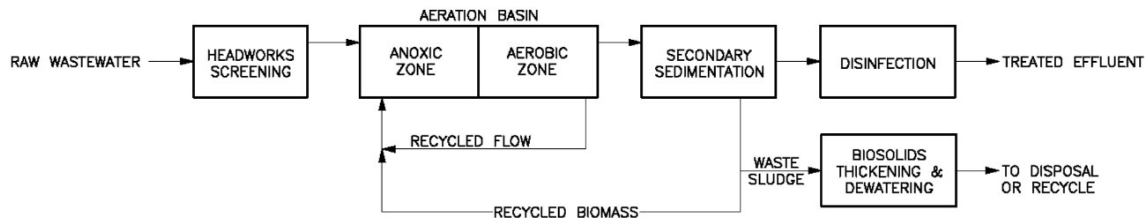



**Figure 4.1**
**FLOW SCHEMATIC FOR AN**
**EXTENDED AERATION MLE PROCESS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

### 4.1.3 BIOLAC® Wastewater Treatment System

The BIOLAC® process developed by Parkson is similar to the extended aeration MLE process with multiple "cells" in a large, lined earthen basin to facilitate biological treatment of the wastewater. A flow schematic for a BIOLAC® system is shown in Figure 4.2.

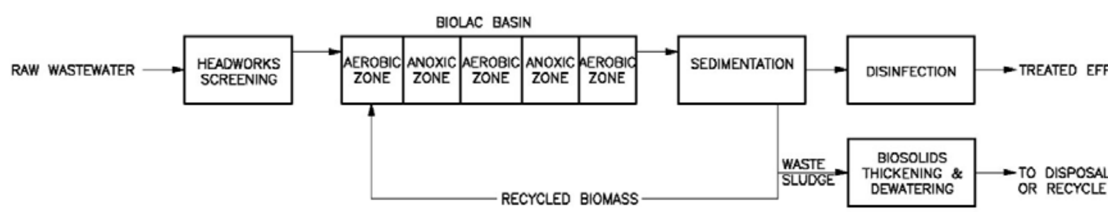



**Figure 4.2**
**FLOW SCHEMATIC FOR BIOLAC**
**EXTENDED AERATION PROCESS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

### 4.1.4 Sequencing Batch Reactor (SBR)

A SBR is an activated sludge system that relies on multiple tanks for biological treatment. Each tank sequentially fills, aerates, settles, and decants the wastewater to achieve the desired water quality objectives. A flow schematic for an SBR system is shown in Figure 4.3.

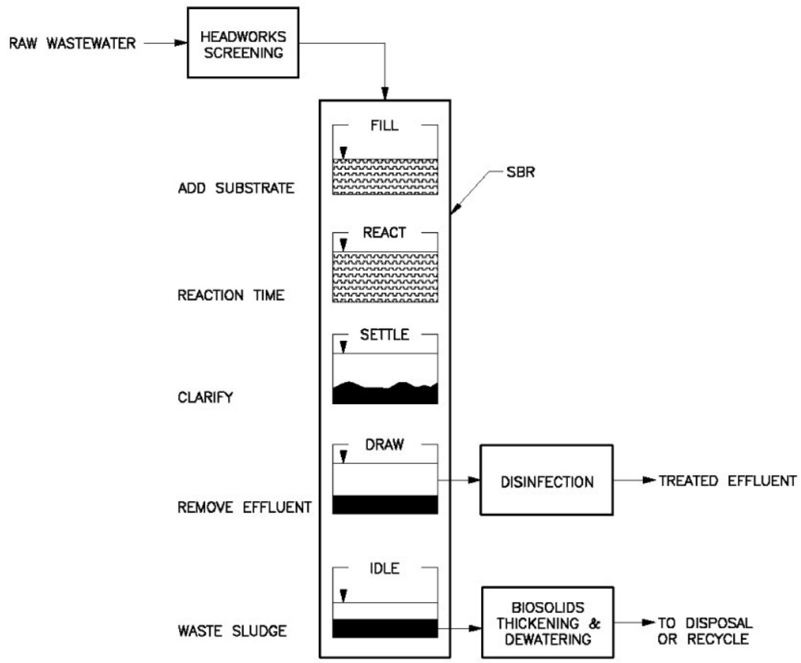



**Figure 4.3**
**FLOW SCHEMATIC FOR**
**AN SBR PROCESS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

### 4.1.5 Oxidation Ditch

An oxidation ditch system is an activated sludge system that consists of a ring or oval-shaped channel equipped with mechanical aeration devices to provide biological treatment. A flow schematic for an oxidation ditch system is shown in Figure 4.4.

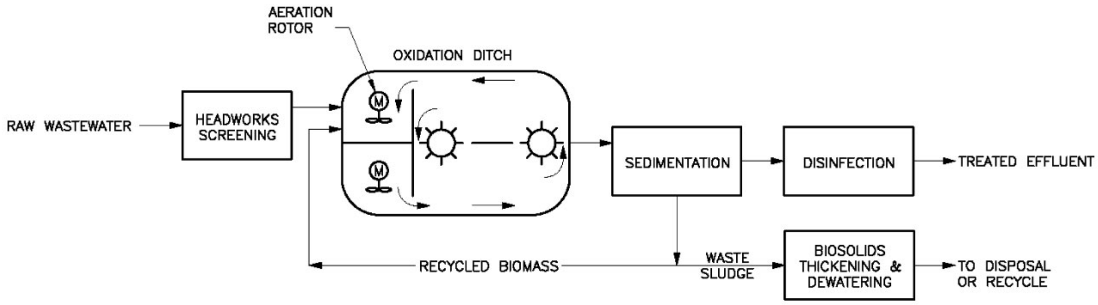



**Figure 4.4**
**FLOW SCHEMATIC FOR**
**AN OXIDATION DITCH PROCESS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

### 4.1.6 Trickling Filters

Trickling filters are an aerobic attached-growth biological treatment process that may include nitrification, but are not typically employed to obtain low levels of nitrogen (denitrification). A flow schematic for a trickling filter system is shown in Figure 4.5.

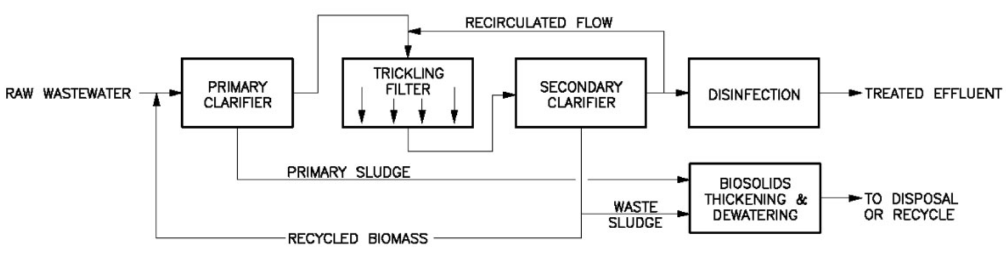



**Figure 4.5**
**FLOW SCHEMATIC FOR**
**A TRICKLING FILTER PROCESS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

## 4.1.7 Partially Mixed Facultative Ponds

Partially mixed facultative ponds include proprietary designs such as Nelson Air Diffusion System (ADS)® and Advanced Integrated Pond System (AIPS)®. Partially mixed facultative ponds can be viewed as a combined biological process that oxidizes organic oxygen demanding material and a physical operation that allows settling of organic and inorganic solids. A flow schematic for a partially mixed facultative pond process is shown in Figure 4.6.

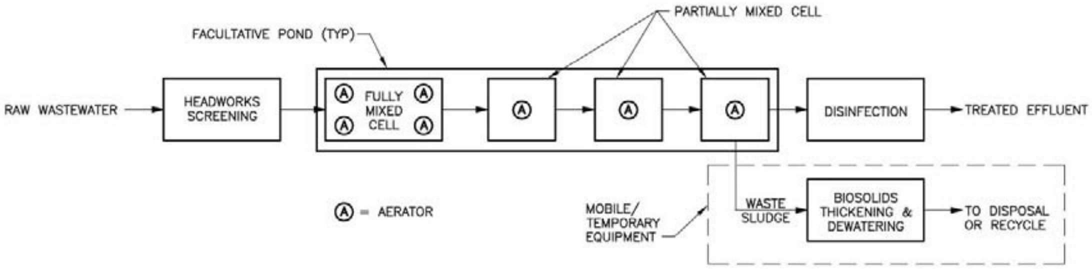



**Figure 4.6**
**FLOW SCHEMATIC FOR A PARTIALLY MIXED FACULTATIVE POND SYSTEM**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

## 4.1.8 Membrane Bio-Reactor (MBR)

A membrane bio-reactor (MBR) system, selected as the Tri-W Project treatment alternative due to the compact footprint, is an activated sludge system similar to extended aeration MLE. However, polymeric membranes are used for separation of treatment organisms from the flow stream, instead of gravity sedimentation tanks. A flow schematic for an MBR system is shown in Figure 4.7.

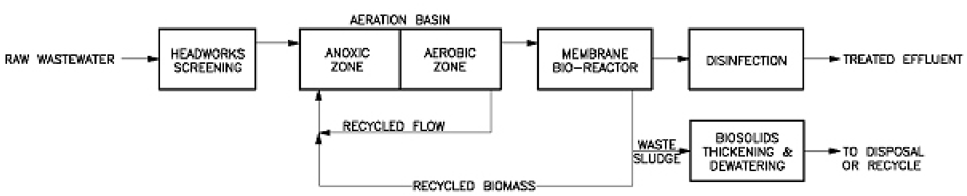



**Figure No. 4.7**
**FLOW SCHEMATIC FOR A MEMBRANE BIO-REACTOR (MBR) PROCESS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

## 4.2 COST BASELINE

A detailed cost summary was completed using cost estimates for recent projects located near Los Osos. Each of the selected projects includes oxidation ditches in the treatment process costs. The cost summary results will be used as a baseline for calibrating cost estimates developed for oxidation ditches, BIOLAC® and other potentially viable treatment alternatives. The selected projects used for the comparison include:

- City of Pismo Beach Wastewater Treatment Facility Expansion (PB)
- California Men's Colony Wastewater Treatment Plant Improvement Project (CMC)
- City of Morro Bay/Cayucos Sanitary District WWTP Facility Master Plan (MBC)

The following treatment processes and plant facilities were included in the construction cost baseline:

- Influent Pump Station
- Preliminary Treatment – headworks, screening, grit removal
- Secondary Treatment
- Disinfection Facilities – UV
- Effluent Pump Station
- Site Facilities – controls, electrical, maintenance building, operations building

Costs for solids treatment and handling were not included as these facilities are detailed in Chapter 5.

Each unit process cost available from the three referenced projects was normalized to units of capacity for each process, i.e. dollars per million gallons of treatment ($/mgd) or dollars per square feet ($/ft$^2$) and adjusted to 2007 dollars.

Table 4.1 shows the cost data for the reference projects with unit costs for each process.

Average unit costs and upper unit costs for each process were used as the basis of cost for the Los Osos community facility. Table 4.2 shows the average and upper costs for each process.

Table 4.3 shows the unit process average and upper construction costs for a 1.4 mgd oxidation ditch facility in Los Osos. The analysis indicates a total construction cost range of $11.6 to $16.3 million. A 1.2 mgd facility assuming STEP/STEG collection is estimated to have a construction cost range of $9.3 to $13.0 million.

**Table 4.1 Cost Comparison of Reference Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Unit/Process | Project | Quantity | Capacity (total) | Units | Construction Cost | Unit Cost[1] | Unit Cost Adjusted[2] |
|---|---|---|---|---|---|---|---|
| Headworks | Pismo Beach | 1 | 1.9 | mgd | $500,000 | $250,000 | $300,000 |
| Headworks | Morro Bay/Cayucos | 1 | 1.5 | mgd | $1,800,000 | $1,200,000 | $1,250,000 |
| Headworks | CMC | 1 | 1.3 | mgd | $1,900,000 | $1,500,000 | $1,900,000 |
| Oxidation Ditch | Pismo Beach | 2 | 1.8 | mgd | $2,300,000 | $1,300,000 | $1,500,000 |
| Oxidation Ditch | Morro Bay/Cayucos | 2 | 1.8 | mgd | $2,900,000 | $1,600,000 | $1,700,000 |
| Oxidation Ditch | CMC | 2 | 1.3 | mgd | $3,000,000 | $2,300,000 | $3,000,000 |
| Secondary Clarifiers | Pismo Beach | 2 | 6,637 | $ft^2$ | $1,200,000 | $180 | $220 |
| Secondary Clarifiers | Morro Bay/Cayucos | 1 | 7,088 | $ft^2$ | $1,900,000 | $260 | $270 |
| Secondary Clarifiers | CMC | 2 | 6,637 | $ft^2$ | $1,300,000 | $190 | $250 |
| RAS/WAS PS | Pismo Beach | 1 | 2,355 | gpm | $300,000 | $124 | $150 |
| RAS/WAS PS | Morro Bay/Cayucos | 1 | 2,990 | gpm | $200,000 | $80 | $80 |
| RAS/WAS PS | CMC | 1 | 2,355 | gpm | $300,000 | $120 | $150 |
| Admin/Maintenance Buildings | Pismo Beach | 1 | 1.9 | mgd | $500,000 | $200,000 | $300,000 |
| Admin/Maintenance Buildings | Morro Bay/Cayucos | 1 | 1.5 | mgd | - | - | - |
| Admin/Maintenance Buildings | CMC | 1 | 1.3 | mgd | $700,000 | $500,000 | $700,000 |
| Electrical Building | Pismo Beach | 1 | 1.9 | mgd | $200,000 | $100,000 | $150,000 |
| Electrical Building | Morro Bay/Cayucos | 1 | 1.5 | mgd | - | - | - |
| Electrical Building | CMC | 1 | 1.3 | mgd | $500,000 | $400,000 | $500,000 |
| Disinfection/Chemical Storage | Pismo Beach | 1 | 1.9 | mgd | $150,000 | $80,000 | $100,000 |
| Disinfection/Chemical Storage | Morro Bay/Cayucos | 1 | 1.5 | mgd | - | - | - |
| Disinfection/Chemical Storage | CMC | 1 | 1.3 | mgd | $900,000 | $700,000 | $900,000 |
| Outfall /Plant Pumps | Pismo Beach | 1 | 1.9 | mgd | $300,000 | $150,000 | $200,000 |
| Outfall /Plant Pumps | Morro Bay/Cayucos | 1 | 1.5 | mgd | - | - | - |
| Outfall /Plant Pumps | CMC | 1 | 1.3 | mgd | $200,000 | $150,000 | $200,000 |
| Yard Piping/Sitework | Pismo Beach | 1 | 1.9 | mgd | $900,000 | $500,000 | $600,000 |
| Yard Piping/Sitework | Morro Bay/Cayucos | 1 | 1.5 | mgd | - | - | - |
| Yard Piping/Sitework | CMC | 1 | 1.3 | mgd | $1,600,000 | $1,300,000 | $1,600,000 |
| Electrical and Instrumentation | Pismo Beach | 1 | 1.9 | mgd | $1,500,000 | $800,000 | $1,000,000 |
| Electrical and Instrumentation | Morro Bay/Cayucos | 1 | 1.5 | mgd | - | - | - |
| Electrical and Instrumentation | CMC | 1 | 1.3 | mgd | $2,400,000 | $1,800,000 | $2,400,000 |

Notes:
(1) Unit Cost is construction cost divided by capacity.
(2) Original cost adjusted to 2007 dollars using ENR CCI indices.

**Table 4.2 Estimated Average and Upper Costs for Los Osos Treatment Facilities**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Unit/Process | Units | Capacity (total) | Average Unit Cost[1] | Average Cost[2] | Upper Unit Cost[1] | Upper Cost[2] |
|---|---|---|---|---|---|---|
| Gravity Collection | | | | | | |
| Headworks | mgd | 1.4 | $1,200,000 | $1,700,000 | $1,900,000 | $2,700,000 |
| Oxidation Ditch | mgd | 1.4 | $2,000,000 | $2,800,000 | $3,000,000 | $4,200,000 |
| Secondary Clarifiers | $ft^2$ | 7,000 | $250 | $1,800,000 | $270 | $1,900,000 |
| RAS/WAS PS | gpm | 2,600 | $130 | $300,000 | $150 | $400,000 |
| Admin/Maintenance Buildings | mgd | 1.4 | $500,000 | $700,000 | $700,000 | $1,000,000 |
| Electrical Building | mgd | 1.4 | $400,000 | $600,000 | $500,000 | $700,000 |
| Disinfection/Chemical Storage | mgd | 1.4 | $500,000 | $700,000 | $900,000 | $1,300,000 |
| Effluent Pumps | mgd | 1.4 | $200,000 | $300,000 | $200,000 | $300,000 |
| Yard Piping/Sitework | mgd | 1.4 | $1,100,000 | $1,500,000 | $1,600,000 | $2,200,000 |
| Electrical and Instrumentation | mgd | 1.4 | $1,700,000 | $2,400,000 | $2,400,000 | $3,400,000 |
| STEP/STEG Collection | | | | | | |
| Headworks(3) | mgd | 1.2 | $800,000 | $1,000,000 | $1,300,000 | $1,600,000 |
| Oxidation Ditch | mgd | 1.2 | $2,000,000 | $2,400,000 | $3,000,000 | $3,600,000 |
| Secondary Clarifiers | $ft^2$ | 6,600 | $250 | $1,700,000 | $270 | $1,800,000 |
| RAS/WAS PS | gpm | 2,400 | $130 | $300,000 | $150 | $350,000 |
| Admin/Maintenance Buildings | mgd | 1.2 | $500,000 | $600,000 | $700,000 | $800,000 |
| Electrical Building | mgd | 1.2 | $400,000 | $500,000 | $500,000 | $600,000 |
| Disinfection/Chemical Storage | mgd | 1.2 | $500,000 | $600,000 | $900,000 | $1,000,000 |
| Effluent Pumps | mgd | 1.2 | $200,000 | $200,000 | $200,000 | $200,000 |
| Yard Piping/Sitework | mgd | 1.2 | $1,100,000 | $1,300,000 | $1,600,000 | $1,900,000 |
| Electrical and Instrumentation | mgd | 1.2 | $1,700,000 | $2,000,000 | $2,400,000 | $2,900,000 |

Notes:
(1) Average or upper unit cost from three reference projects presented in Table 4.1.
(2) Average or upper cost for Los Osos based on capacity times unit cost.
(3) Average and upper unit costs may overstate headworks costs for STEP/STEG due to elimination of screening and grit removal requirements. 70% of gravity system used to account for influent pumping, metering, septage receiving, and other minor headworks facilities.

**Table 4.3 Cost Comparison of Reference Projects and Estimated Los Osos Baseline Cost**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Reference Projects | | | | | | Los Osos Community Facility Baseline Cost Gravity Collection | | | | Los Osos Community Facility Baseline Cost STEP/STEG Collection | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CMC(1) | | PB(1) | | MB(1) | | Oxidation Ditch | | BIOLAC® | | Oxidation Ditch | | BIOLAC® | |
| **Total Construction Costs** | **Original Cost** | **Adjusted Cost(2)** | **Original Cost** | **Adjusted Cost(2)** | **Original Cost** | **Adjusted Cost(2)** | **Average Cost** | **Upper Cost** | **Average Cost** | **Upper Cost** | **Average Cost** | **Upper Cost** | **Average Cost** | **Upper Cost** |
| Headworks | $1,900,000 | $2,400,000 | $500,000 | $500,000 | $1,800,000 | $1,900,000 | $1,700,000 | $2,700,000 | $1,700,000 | $2,700,000 | $1,000,000 | $1,600,000 | $1,000,000 | $1,600,000 |
| Oxidation Ditch (extended aeration) | $3,000,000 | $3,900,000 | $2,300,000 | $2,700,000 | $2,900,000 | $2,900,000 | $2,800,000 | $4,200,000 | - | - | $2,400,000 | $3,600,000 | - | - |
| BIOLAC® Process(3) | - | - | - | - | - | - | - | - | $1,300,000 | $1,300,000 | | - | $1,100,000 | $1,100,000 |
| Secondary Clarifiers | $1,300,000 | $1,700,000 | $1,200,000 | $1,400,000 | $1,900,000 | $1,900,000 | $1,800,000 | $1,900,000 | $1,800,000 | $1,900,000 | $1,600,000 | $1,800,000 | $1,600,000 | $1,800,000 |
| RAS/WAS Pump Station | $300,000 | $400,000 | $300,000 | $300,000 | $200,000 | $300,000 | 300,000 | $400,000 | $300,000 | $400,000 | $300,000 | $400,000 | $300,000 | $400,000 |
| Admin/Maintenance Buildings | $700,000 | $900,000 | $500,000 | $500,000 | - | - | $700,000 | $1,000,000 | $700,000 | $1,000,000 | $600,000 | $800,000 | $600,000 | $800,000 |
| Electrical Building | $500,000 | $700,000 | $200,000 | $300,000 | - | - | $600,000 | $700,000 | $600,000 | $700,000 | $500,000 | $600,000 | $500,000 | $600,000 |
| Disinfection/Chemical Storage | $900,000 | $1,200,000 | $200,000 | $200,000 | - | - | $700,000 | $1,300,000 | $700,000 | $1,300,000 | $600,000 | $1,000,000 | $600,000 | $1,000,000 |
| Effluent Pump Station | $200,000 | $300,000 | $300,000 | $300,000 | - | - | $300,000 | $300,000 | $300,000 | $300,000 | $200,000 | $200,000 | $200,000 | $200,000 |
| Subtotal 1 | $8,800,000 | $11,500,000 | $7,200,000(5) | $8,200,000(5) | $6,800,000 | $7,000,000 | $8,900,000 | $12,500,000 | $7,400,000 | $9,600,000 | $7,200,000 | $10,000,000 | $5,900,000 | $7,500,000 |
| Yard Piping/Sitework 4 | $1,600,000 | $2,100,000 | $900,000 | $1,100,000 | $300,000 | $400,000 | $900,000 | $1,300,000 | $700,000 | $1,000,000 | $700,000 | $1,000,000 | $600,000 | $800,000 |
| Electrical and Instrumentation 4 | $2,400,000 | $3,100,000 | $1,500,000 | $1,800,000 | $1,000,000 | $1,100,000 | $1,800,000 | $2,500,000 | $1,500,000 | $1,900,000 | $1,400,000 | $2,000,000 | $1,200,000 | $1,500,000 |
| Total Construction Cost | $12,800,000 | $16,700,000 | $9,600,000 | $11,100,000 | $8,100,000 | $8,500,000 | $11,600,000 | $16,300,000 | $9,600,000 | $12,500,000 | $9,300,000 | $13,000,000 | $7,700,000 | $9,800,000 |

Notes:
(1) CMC = California Men's Colony; PB = Pismo Beach, CA; MB = Morro Bay Cayucos Sanitary District, CA.
(2) Original Cost estimate adjusted to Feb 2007 dollars (ENR = 7879).
(3) Includes blowers/diffusers/PLC/valves/aeration chains, air piping, blower building/MCCs.
(4) For Los Osos, Yard Piping/Sitework is estimated at 10% and Electrical/Instrumentation is 20% of Subtotal 1 cost.
(5) Includes additional miscellaneous site features with original cost of $1,700,000.

The BIOLAC® system is similar to an oxidation ditch facility except that the concrete oxidation ditches are replaced with earthen, plastic lined aeration basins. Average and upper unit costs were developed for BIOLAC® aeration basins and equipment based on vendor budgetary estimates to replace the oxidation ditch cost in Table 4.2. Table 4.3 shows the resulting construction costs for a 1.4 mgd BIOLAC® facility in Los Osos.

The analysis indicates a total construction cost range of $9.6 to $12.5 million. This is approximately 20 percent less than an oxidation ditch facility. A 1.2 mgd BIOLAC® facility is estimated to have a construction cost range of $7.7 to $9.8 million.

The BIOLAC® estimate was confirmed with bid prices for the Imperial Valley WWTP (Imperial, CA) which included 1 mgd of BIOLAC® treatment capacity. The BIOLAC® portion (i.e. new 1 mgd BIOLAC® basin and integral clarifiers, blowers, blower building, and related piping, valves, etc.) accounted for approximately $2.5 to $3.0 million of the overall bid price. Therefore, the $2.8 to $3.2 million estimated for the BIOLAC® process cost baseline appears consistent.

# 4.3 COST DEVELOPMENT

## 4.3.1 Process Modeling

### 4.3.1.1 Design Criteria

Using the per capita flow and the buildout population summarized in the Potential Viable Project Alternative Rough Screening Analysis (Carollo Engineers, March 2007), the dry weather wastewater flow is projected to be 1.2 million gallons a day (mgd). Wet weather wastewater flow is projected to be 1.2 mgd for a STEP/STEG (STEP) collection system and 1.4 mgd for a gravity collection system.

Influent concentrations for conventional gravity collection systems and STEP collection systems were estimated, as presented in Table 4.4 (Rough Screening Analysis, Carollo March 2007).

**Table 4.4 Projected Characteristics of Treatment Facility Influent Wastewater
Los Osos Wastewater Project Development
San Luis Obispo County**

| Parameter | Units | Gravity System[1] | STEP System[2] |
|---|---|---|---|
| BOD | mg/L | 340 | 120 |
| Suspended Solids | mg/L | 390 | 40 |
| Total Nitrogen | mg/L | 56 | 56 |

Notes:
(1) Estimate from Montgomery Watson Harza, Inc., 2003.
(2) Estimate from review by Bounds, T.R., 1997, assuming filtering of STEP effluent.

### 4.3.2 Unit Process Sizing

Influent design criteria were modeled with BioTran© to develop unit process sizing and expected effluent quality. BioTran© (Biological Treatment Analysis for Wastewater Treatment) is a calculation template for steady state analysis of typical wastewater treatment processes and configurations developed by Carollo Engineers for preliminary sizing and process analysis of wastewater treatment plants. The program takes input of flow, loadings, and unit process sizes and calculates expected mass balance rates and effluent quality. The program incorporates unit process models for primary treatment, activated sludge treatment, trickling filter treatment, tertiary filters, chlorination contact tanks, and common solids handling unit processes including gravity belt thickeners, gravity thickeners, centrifuges, aerobic and anaerobic digesters. BioTran© has been configured to work together with the commercial biological treatment software, BioWin©, developed by Envirosim, Inc.

Preliminary unit process sizes for each treatment alternative assuming a gravity collection system influent quality are shown in Table 4.5. A similar table assuming STEP collection influent quality is shown in Table 4.6. A STEP collection system, with reduced loading, results in decreased capacity requirements for some of the unit processes such as grit removal, aeration basins, and solids handling.

### 4.3.3 Effluent Quality

Anticipated water quality objectives for disposal/reuse alternatives are presented in Chapter 2 of the Rough Screening Analysis (Carollo, March 2007).

Estimated secondary effluent characteristics based on BioTran© modeling for a gravity collection system are presented in Table 4.7. Total nitrogen levels for trickling filter or facultative pond may limit the disposal/reuse alternative or require additional treatment as discussed later in this chapter.

Estimated secondary effluent characteristics based on Biotran© modeling for a STEP collection system are presented in Table 4.8. Total nitrogen levels for all treatment options are significant and may limit the disposal/reuse alternatives or require additional treatment as discussed later in this chapter.

**Effluent Nitrogen Limits**
Effluent disposal/reuse options may require total nitrogen levels significantly lower than produced by secondary treatment processes evaluated. This is not a barrier to implementation of a particular technology; however, it may limit the viable disposal/reuse options or require additional treatment. Additional treatment, nitrification and/or denitrification, considerations and costs are detailed in Section 4.6 of this report.

**Table 4.5 Modeled Unit Process Sizing (Assuming a Gravity Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | | **Treatment Alternatives** | | | | | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **Extended Aeration - MLE** | **BIOLAC®** | **SBR** | **Oxidation Ditch** | **Trickling Filter** | **Partially Mixed Facultative Pond** |
| *Primary Clarifier:* | | | | | | | |
| No. of basins | # | - | - | - | - | 2 | - |
| Diameter | ft | - | - | - | - | 35 | - |
| Volume (total) | gal | - | - | - | - | 180,000 | - |
| Surface overflow rate | gpd/sf | - | - | - | - | 1,500 | - |
| *Trickling Filters:* | | | | | | | |
| No. of filters | # | - | - | - | - | 2 | - |
| Diameter | ft | - | - | - | - | 30 | - |
| Surface area (total) | sf | - | - | - | - | 1,500 | - |
| *Solids Contact Basins:* | | | | | | | |
| No. of Basins | # | - | - | - | - | 2 | - |
| Volume (total) | gal | - | - | - | - | 250,000 | - |
| Hydraulic detention time | hrs | - | - | - | - | 4 | - |
| Solids residence time (total) | days | - | - | - | - | 2.7 | - |
| *Aeration Basins:* | | | | | | | |
| No. of basins | # | 2 | 2 | - | 2 | - | - |
| Length | ft | 140 | 250 | - | 175 | - | - |
| Width | ft | 35 | 63 | - | 44 | - | - |
| Side water depth | ft | 17 | 17 | - | 12 | - | - |
| Volume (total) | gal | 1,250,000 | 4,000,000 | - | 1,400,000 | - | - |
| Hydraulic detention time | hrs | 22 | 70 | - | 24 | - | - |
| Solids residence time (total) | days | 7.2 | 26.2 | - | 8.1 | - | - |
| *Secondary Clarifiers:* | | | | | | | |
| No. of basins | # | 2 | 2 | - | 2 | 2 | - |
| Diameter | ft | 50 | 60 | - | 50 | 50 | - |
| Volume (total) | gal | 410,000 | 600,000 | - | 410,000 | 410,000 | - |
| Surface overflow rate | gpd/sf | 330 | 230 | - | 330 | 330 | - |
| *SBR Tanks:* | | | | | | | |
| No. of tanks | | - | - | 2 | - | - | - |
| Normal cycles per day | # | - | - | 4 | - | - | - |
| Normal cycle time (total) | #/day | - | - | 250 | - | - | - |
| Volume (total) | gal | - | - | 1,400,000 | - | - | - |
| Hydraulic detention time (max month) | hrs | - | - | 25 | - | - | - |
| | | - | - | | - | - | - |
| Aerobic solids residence time (max month) | days | - | - | 5.5 | - | - | - |
| *Partial Mix Facultative Ponds:* | | | | | | | |
| No. of trains | # | - | - | - | - | - | 2 |
| No. of cells (each train) | # | - | - | - | - | - | 3 |
| Volume (total) | gal | - | - | - | - | - | 14,000,000 |
| Hydraulic detention time (total) | days | - | - | - | - | - | 20 |

**Table 4.6 Modeled Unit Process Sizing (Assuming a STEP Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Parameter | Units | Treatment Alternatives | | | | | |
|---|---|---|---|---|---|---|---|
| | | Extended Aeration - MLE | BIOLAC® | SBR | Oxidation Ditch | Trickling Filter | Partially Mixed Facultative Pond |
| *Primary Clarifier:* | | | | | | | |
| No. of basins | # | - | - | - | - | 2 | - |
| Diameter | ft | - | - | - | - | 35 | - |
| Volume (total) | gal | - | - | - | - | 180,000 | - |
| Surface overflow rate | gpd/sf | - | - | - | - | 1,500 | - |
| *Trickling Filters:* | | | | | | | |
| No. of filters | # | - | - | - | - | 2 | - |
| Diameter | ft | - | - | - | - | 25 | - |
| Surface area (total) | sf | - | - | - | - | 1,000 | - |
| *Solids Contact Basins:* | | | | | | | |
| No. of Basins | # | - | - | - | - | 2 | - |
| Volume (total) | gal | - | - | - | - | 50,000 | - |
| Hydraulic detention time | hrs | - | - | - | - | 1 | - |
| Solids residence time (total) | days | - | - | - | - | 2.0 | - |
| *Aeration Basins:* | | | | | | | |
| No. of basins | # | 2 | 2 | - | 2 | - | - |
| Length | ft | 70 | 110 | - | 88 | - | - |
| Width | ft | 18 | 28 | - | 22 | - | - |
| Side water depth | ft | 17 | 17 | - | 12 | - | - |
| Volume (total) | gal | 320,000 | 780,000 | - | 350,000 | - | - |
| Hydraulic detention time | hrs | 6 | 14 | - | 6 | - | - |
| Solids residence time (total) | days | 8.0 | 25.6 | - | 9.5 | - | - |
| *Secondary Clarifiers:* | | | | | | | |
| No. of basins | # | 2 | 2 | - | 2 | 2 | - |
| Diameter | ft | 50 | 60 | - | 50 | 50 | - |
| Volume (total) | gal | 410,000 | 600,000 | - | 410,000 | 410,000 | - |
| Surface overflow rate | gpd/sf | 330 | 230 | - | 330 | 330 | - |
| *SBR Tanks:* | | | | | | | |
| No. of tanks | | - | - | | - | - | - |
| Normal cycles per day | # | - | - | 2 | - | - | - |
| Normal cycle time (total) | #/day | - | - | 4 | - | - | - |
| Volume (total) | gal | - | - | 350 | - | - | - |
| Hydraulic detention time (max month) | hrs | - | - | 1,200,000 | - | - | - |
| | | - | - | 21 | - | - | - |
| Aerobic solids residence time (max month) | days | - | - | 19.1 | - | - | - |
| *Partial Mix Aerated Lagoons:* | | | | | | | |
| No. of trains | # | - | - | - | - | - | 2 |
| No. of cells (each train) | # | - | - | - | - | - | 3 |
| Volume (total) | gal | - | - | - | - | - | 14,000,000 |
| Hydraulic detention time (total) | days | - | - | - | - | - | 20 |

**Table 4.7 Modeled Secondary Effluent Characteristics (Assuming a Gravity Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Parameter | Units | Extended Aeration MLE | BIOLAC® | Sequencing Batch Reactor (SBR) | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR) |
|---|---|---|---|---|---|---|---|---|
| BOD | mg/L | 3 | 1 | 9 | 3 | 5 | 10 | 1 |
| TSS | mg/L | 10 | 10 | 10 | 10 | 10 | 60 | 0.5 |
| Total Nitrogen | mg/L | 7 | 7 | 7 | 7 | 38(1) | 15(1) | 7 |

Note:

(1) Refer to text box on Effluent Nitrogen Limits.

**Table 4.8 Modeled Secondary Effluent Characteristics (Assuming a STEP Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Parameter | Units | Extended Aeration MLE | BIOLAC® | Sequencing Batch Reactor (SBR) | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR) |
|---|---|---|---|---|---|---|---|---|
| BOD | mg/L | 5 | 3 | 9 | 4 | 7 | 4 | 1 |
| TSS | mg/L | 10 | 10 | 10 | 10 | 10 | 60 | 0.5 |
| Total Nitrogen(1) | mg/L | 36 | 37 | 35 | 39 | 48 | 54 | 35 |

Note:

(1) Refer to text box on Effluent Nitrogen Limits.

## 4.4 CAPITAL COST

Conceptual design cost estimates were prepared for each potentially viable treatment alternative. The estimates include both capital and operation and maintenance (O&M) costs for new facilities in accordance with Carollo Engineer's Unit Price Catalog. The estimate is based on an estimate of major structural and mechanical components with allowances made for piping and miscellaneous mechanical components, electrical and instrumentation costs, site work, mobilization/demobilization and general conditions. The estimated construction costs include the following processes/area:

- Preliminary Treatment (influent pump station, headworks [gravity only], screening [gravity only], grit removal [gravity only], septage receiving)
- Primary Treatment (sedimentation tanks for trickling filter alternative only)

- Secondary Treatment (main components of each treatment alternative)
- Disinfection Facilities (UV assumed)
- Effluent Pump Station
- Site Facilities (controls, electrical, maintenance building, operations building, odor control, site roads and basic improvements to roadways for site access)

Tables 4.9 and 4.10 show the estimated construction costs for each of the main facility areas as well as the total construction cost assuming a gravity collection system and a STEP collection system, respectively.

Baseline construction costs for oxidation ditches developed above range from $11.6 to $16.3 million assuming gravity collection. Baseline construction costs for BIOLAC® developed above range from $9.6 to $12.5 million assuming gravity collection. The construction estimates of $15.1 million for an oxidation ditch facility presented in Table 4.10 falls within the middle of the baseline.

The construction estimate of $13.2 million for BIOLAC® is on the upper end of the baseline value. However, the baseline for BIOLAC® is based on limited information from the BIOLAC® manufacturer and reference data from Imperial Valley for the secondary treatment process. The BIOLAC® estimate still shows a relative cost savings over oxidation ditches of approximately 15 percent.

The estimates, calibrated with the baseline estimates for oxidation ditches and BIOLAC®, show that partially mixed facultative ponds have the lowest overall construction cost for alternatives with gravity or STEP collection. BIOLAC® and oxidation ditches are the next apparent low cost alternatives. Extended aeration MLE, SBR and trickling filters have the highest apparent construction costs.

## 4.5 O&M COST BASIS

Annual O&M costs for each of the treatment alternatives were estimated for the following categories based on BioTran© modeling of unit process requirements.

- Labor
- Power
- Maintenance/ Equipment Replacement
- Allowances - Includes chemicals and screenings and grit disposal where applicable

The estimated annual power usage for each alternative is shown in Table 4.11.
The estimated annual labor hours for each alternative are shown in Table 4.12.

**Table 4.9 Estimated Treatment Plant Construction Costs (Assuming a Gravity Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Process/Area | Construction Cost (millions of dollars)[1] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Extended Aeration MLE | BIOLAC® | Sequencing Batch Reactor (SBR) | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR) |
| Preliminary Treatment | $2.9 | $2.5 | $2.9 | $2.9 | $2.9 | $1.8 | $N/A |
| Primary Treatment | $- | $- | $- | $- | $0.9 | $- | $N/A |
| Secondary Treatment | $7.9 | $4.8 | $8.5 | $5.9 | $6.0 | $2.7 | $N/A |
| Disinfection Facilities | $1.4 | $1.4 | $1.4 | $1.4 | $1.4 | $2.2 | $N/A |
| Effluent Pump Station | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $N/A |
| Site Facilities | $4.3 | $3.9 | $4.3 | $4.3 | $4.0 | $4.0 | $N/A |
| Subtotal Construction Cost[2] | $17.1 | $13.2 | $17.7 | $15.1 | $15.8 | $11.3 | $N/A |
| Contingency (30%) | $5.1 | $4.0 | $5.3 | $4.5 | $4.7 | $3.4 | $N/A |
| Total Construction Cost[1] | $22.2 | $17.2 | $23.0 | $19.6 | $20.5 | $14.7 | $55[3] |

N/A - Not Available [3]
Notes:
(1) All costs are in February 2007 dollars, based on an ENR of 7879.
(2) Total construction costs do not include design, construction management, and legal/administrative costs. Refer to Chapter 7 for project costs.
(3) Construction cost based on bid tab values for Tri-W Project. Bid tab values do not include separate costs for individual processes/areas. Bid tab values include solids treatment costs not included for other treatment processes.

**Table 4.10 Estimated Treatment Plant Construction Costs (Assuming a STEP Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Construction Cost (millions of dollars)[1] | | | | | | |
|---|---|---|---|---|---|---|---|
| **Process/Area** | **Extended Aeration MLE** | **BIOLAC®** | **Sequencing Batch Reactor (SBR)** | **Oxidation Ditch** | **Trickling Filters** | **Partially Mixed Facultative Ponds** | **Membrane Bio-Reactor (MBR)[3]** |
| Preliminary Treatment | $1.7 | $1.4 | $1.7 | $1.7 | $1.7 | $1.7 | $N/A |
| Primary Treatment | $- | $- | $- | $- | $0.8 | $- | $N/A |
| Secondary Treatment | $7.1 | $4.0 | $7.3 | $5.1 | $5.1 | $2.5 | $N/A |
| Disinfection Facilities | $1.3 | $1.3 | $1.3 | $1.3 | $1.3 | $2.0 | $N/A |
| Effluent Pump Station | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $0.6 | $N/A |
| Site Facilities | $4.0 | $3.6 | $4.0 | $4.0 | $4.0 | $3.7 | $N/A |
| Subtotal Construction Cost[2] | $14.7 | $10.9 | $14.9 | $12.7 | $13.5 | $10.5 | $N/A |
| Contingency (30%) | $4.4 | $3.3 | $4.5 | $3.8 | $4.1 | $3.2 | $N/A |
| Total Construction Cost[2] | $19.1 | $14.2 | $19.4 | $16.5 | $17.6 | $13.7 | $N/A |

N/A - Not Available [3]

Notes:

(1) All costs are in February 2007 dollars, based on an ENR of 7879.

(2) Total construction costs do not include design, construction management, and legal/administrative costs. Refer to Chapter 7 for project costs.

(3) Tri-W Project costs based on gravity collection system. Based on other treatment process costs, costs associated with STEP collection could be approximately 10 to 15% less than when associated with a gravity collection system.

**Table 4.11 Estimated Annual Energy Usage for Each Treatment Alternative**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Extended Aeration MLE | Sequencing Batch Reactor (SBR) | BIOLAC® | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR) |
|---|---|---|---|---|---|---|---|
| **Annual Energy Usage,(kWh/yr)[1]** | | | | | | | |
| Gravity Collection System | 700,000 | 1,100,000 | 1,100,000 | 900,000 | 700,000 | 600,000 | 1,300,000 |
| STEP Collection System | 600,000 | 1,000,000 | 800,000 | 800,000 | 600,000 | 600,000 | 1,200,000 |

Note:
(1) Estimate does not include tertiary treatment, solids treatment, collection system or reuse/disposal.

**Table 4.12 Estimated Annual Labor Hours for Each Treatment Alternative**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Annual Labor, hrs/FTE [1,2] | | | | | | |
|---|---|---|---|---|---|---|---|
| | Extended Aeration MLE | Sequencing Batch Reactor (SBR) | BIOLAC® | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR) |
| **Gravity Collection System** | | | | | | | |
| Annual Labor (hrs)[1] | 5,200 | 4,160 | 5,200 | 5,200 | 5,200 | 4,160 | 4,160 |
| Full Time Equivalent[1,2] | 2.5 | 2.0 | 2.5 | 2.5 | 2.5 | 2.0 | 2.0 |
| **STEP Collection System** | | | | | | | |
| Annual Labor (hrs)[1] | 4,160 | 4,160 | 4,160 | 4,160 | 5,200 | 4,160 | N/A |
| Full Time Equivalent[1,2] | 2.0 | 2.0 | 2.0 | 2.0 | 2.5 | 2.0 | N/A |

N/A - Not Available.
Notes:
(1) Estimate does not include tertiary treatment, solids treatment, collection system or reuse/disposal.
(2) FTE - full time equivalent employee (2080 hours per year).

Tables 4.13 and 4.14 show the O&M costs of the treatment alternatives assuming gravity and STEP collection systems, respectively.

**Table 4.13 Estimated Annual O&M Costs (Assuming a Gravity Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| O&M Description | Extended Aeration MLE | BIOLAC® | Sequencing Batch Reactor (SBR) | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR)(4) |
|---|---|---|---|---|---|---|---|
| Labor(1) | $310,000 | $310,000 | $250,000 | $310,000 | $310,000 | $250,000 | $250,000 |
| Power(2) | $80,000 | $130,000 | $130,000 | $110,000 | $80,000 | $70,000 | $160,000 |
| Maintenance/ Replacement(3) | $260,000 | $210,000 | $230,000 | $220,000 | $230,000 | $170,000 | $280,000 |
| Allowances | $50,000 | $50,000 | $50,000 | $50,000 | $50,000 | $20,000 | $50,000 |
| Total | $700,000 | $700,000 | $660,000 | $690,000 | $670,000 | $510,000 | $740,000 |

Notes:
(1) Labor costs are based on an average $60 hourly rate, including direct and indirect costs.
(2) Power costs based on $0.12 per kWh electrical rate.
(3) Maintenance cost is 2% of structural capital cost and equipment replacement is 4% of equipment capital costs.
(4) Based on Final Project Report (Montgomery Watson Americas, March 2001) costs and February 2005 estimates for Tri-W Project, escalated to 2007 at 5 % per year. Does not include Solids Handling facilities estimated in Chapter 5.

**Table 4.14 Estimated Annual O&M Costs (Assuming a STEP Collection System)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Treatment Alternative | | | | | | |
|---|---|---|---|---|---|---|---|
| O&M Description | Extended Aeration MLE | BIOLAC® | Sequencing Batch Reactor (SBR) | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bio-Reactor (MBR)(4) |
| Labor(1) | $250,000 | $250,000 | $250,000 | $250,000 | $310,000 | $250,000 | $N/A |
| Power(2) | $70,000 | $100,000 | $120,000 | $100,000 | $70,000 | $70,000 | $N/A |
| Maintenance/ Replacement(3) | $230,000 | $180,000 | $200,000 | $200,000 | $210,000 | $170,000 | $N/A |
| Allowances | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $20,000 | $N/A |
| Total | $570,000 | $550,000 | $590,000 | $570,000 | $610,000 | $510,000 | $N/A |

N/A - Not Applicable(4)
Notes:
(1) Labor costs are based on an average $60 hourly rate, including direct and indirect costs.
(2) Power costs based on $0.12 per kWh electrical rate.
(3) Maintenance cost is 2% of structural capital cost and equipment replacement is 4% of equipment capital costs.
(4) Tri-W costs developed in the Final Project Report (Montgomery Watson Americas, March 2001) based on gravity collection system. Based on other costs, MBR O&M when associated with STEP collection could be approximately 10 to 20% less than when associated with a gravity collection system.

## 4.6 EFFLUENT NITROGEN CONSIDERATIONS

High nitrogen effluent levels may not be compatible with some reuse/disposal alternatives. The nitrogen levels estimated by BioTran© modeling for each of the treatment alternatives are shown in Table 4.15.

**Table 4.15 Estimated Nitrogen Removal Limits for Each Treatment Alternative**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Extended Aeration MLE | BIOLAC® | Sequencing Batch Reactor (SBR) | Oxidation Ditch | Trickling Filters | Partially Mixed Facultative Ponds | Membrane Bi-Reactor (MBR) |
|---|---|---|---|---|---|---|---|
| **Nitrogen Removal Limit, Total-N, mg/L** | | | | | | | |
| Gravity Collection System | 7 | 7 | 7 | 7 | 38 | 15 | 7 |
| STEP Collection System | 36 | 37 | 35 | 39 | 48 | 54 | 35 |

Effluent from trickling filters and partially mixed facultative ponds is generally not fully nitrified no matter which collection system is employed. In order to reduce the total nitrogen level to low levels required by certain disposal/reuse options (e.g. leach fields), nitrification and denitrification facilities have historically been required. However, recent facultative pond case studies indicate nitrification can be achieved with minor modifications to the pond system. Should these case studies provide long-term successful operational results at the time of final design, nitrification costs for partially mixed facultative ponds may be substantially reduced.

Nitrifying trickling filters may be employed for nitrification (conversion of ammonia to nitrite/nitrate). Table 4.16 summarizes approximate construction and O&M costs for various sizes of nitrifying trickling filter facilities. Side stream treatment of only flows requiring low nitrogen levels will minimize the construction and O&M costs.

The ability of a partially mixed facultative pond system to fully nitrify should be ascertained during value engineering and detailed design. This could substantially reduce the costs associated with nitrification assuming low nitrogen levels are required for disposal/reuse implementation.

STEP septic tanks retain a large fraction of carbonaceous constituents and separate denitrification processes, in addition to the secondary treatment technology options, are required to meet low nitrogen levels if necessary.

| Table 4.16 | Nitrification Costs for Trickling Filters and Partially Mixed Facultative Ponds<br>Los Osos Wastewater Project Development<br>San Luis Obispo County | | |
|---|---|---|---|
| | **Side-Stream Flows for Nitrification (mgd)** | | |
| **Nitrifying Trickling Filter** | **0.4** | **0.8** | **1.2/1.4** |
| Construction Cost ($M)[1,2] | 1.2 | 2.4 | 3.8 |
| Total Annual O&M Costs[3] | $35,000 | $60,000 | $90,000 |

Notes:

(1) All costs in February 2007 dollars, based on an ENR of 7879.

(2) Includes 30% construction contingency. Total construction costs do not include design, construction management, and legal/administrative costs. Refer to Chapter 7 for project costs.

(3) Annual O&M includes power, maintenance at 2% of structural capital cost, and equipment replacement at 4% of equipment capital cost.

Denitrification filters and methanol as a carbon source may be employed following secondary treatment of STEP wastewater to meet effluent nitrogen levels of 7 mg/L. In addition, denitrification may be required for trickling filters and partially mixed facultative ponds associated with gravity collection.

Table 4.17 summarizes approximate construction and O&M costs for various treatment flows. Side stream treatment may limit the methanol requirements (O&M costs) while providing the water quality required for certain reuse/disposal alternatives.

| Table 4.17 | Denitrification Costs<br>Los Osos Wastewater Project Development<br>San Luis Obispo County | | |
|---|---|---|---|
| | **Side-Stream Flows from Denitrification (mgd)** | | |
| **Denitrification Filter** | **0.4** | **0.8** | **1.2/1.4** |
| Construction Cost ($M)[1,2] | 1.1 | 2.2 | 3.6 |
| Methanol (MeOH) Required (gpd) | 50 | 90 | 150 |
| Annual Methanol Costs [3] | $60,000 | $100,000 | $160,000 |
| Annual Maintenance /Replacement[4] | $30,000 | $60,000 | $90,000 |
| Total Annual O&M Costs | $90,000 | $160,000 | $250,000 |

Notes:

(1) All costs are in February 2007 dollars, based on an ENR of 7879.

(2) Includes 30% construction contingency. Total construction costs do not include design, construction management, and legal/administrative costs. Refer to Chapter 7 for project costs.

(3) Methanol costs estimated to be $3.00 per gallon.

(4) Maintenance cost is 2% of structural capital cost, equipment replacement is 4% of equipment capital cost, and media replacement is 5% of media costs.

## 4.7 ACREAGE REQUIREMENTS

The estimated acreage required for each treatment alternative for influent pumping through secondary treatment is shown in Table 4.18. These values are similar to those presented in the Rough Screening Analysis (Carollo Engineers, March 2007), and are based on unit process sizing from BioTran© modeling presented above. These estimates do not include solids treatment acreage requirements, which are provided separately in the Solids Treatment and Disposal chapter.

**Table 4.18 Summary of Treatment Process Acreage Requirements**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Treatment Alternative | Gravity Collection System | STEP Collection System |
|---|---|---|
| **Estimated Acreage Required (acres)** | | |
| Extended Aeration MLE | 6 | 6 |
| Sequencing Batch Reactor (SBR) | 6 | 6 |
| BIOLAC® | 10 | 8 |
| Oxidation Ditch | 8 | 8 |
| Trickling Filters | 6 | 6 |
| Partially Mixed Facultative Ponds | 20 | 20 |
| Membrane Bio-Reactor (MBR) | 4 | 4 |

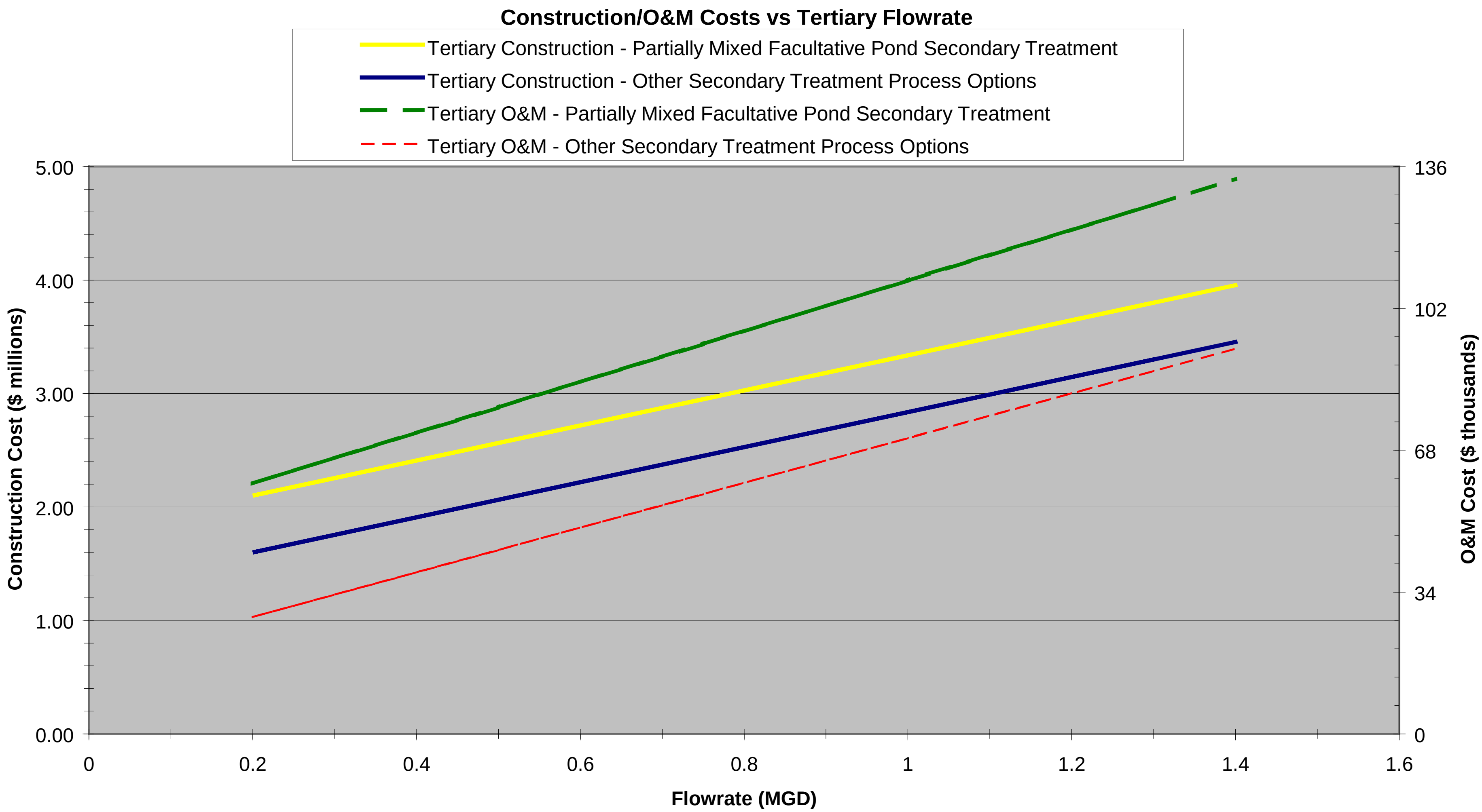
## 4.8 TERTIARY TREATMENT CONSIDERATIONS

Estimated construction costs for tertiary filtration are shown in Figure 4.8. The cost ranges from approximately $1.6 to $3.5 million for 0.2 to 1.4 mgd, respectively. O&M costs range from $30,000 to $100,000 per year depending on tertiary flows.

Partially mixed facultative ponds require additional pretreatment due to high suspended solids effluent from the secondary treatment system. Construction costs range from $2.1 to $4.0 million for tertiary treatment of facultative pond effluent. O&M costs range from approximately $60,000 to $130,000 per year depending on tertiary flows. Addition of tertiary treatment will be dictated by reuse/disposal water quality requirements and considered during development of viable project alternatives (Chapter 7).

## 4.9 ENVIRONMENTAL/PERMITTING CONSIDERATIONS

For most of the alternatives, the environmental effects and required mitigation for each of the treatment alternatives will be the same or similar.




NOTES:

1. All costs in April 2007 dollars based on an ENR CCI of 7879
2. Total construction costs do not include contingencies, design, construction management, legal/administrative, sales tax and contractor overhead and profit. Contingency of 30% included. Refer to Chapter 7 for project costs.

**Figure 4.8**
**CONSTRUCTION/O&M COSTS VS TERTIARY FLOWRATE**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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- Construction activities are similar to any building development. Short-term effects will include impacts to air quality, noise increases, traffic increases, and visual disturbances.
- Depending upon the location, treatment plant siting could disrupt archaeological, agricultural, or biological resources. These issues are discussed in Chapter 6 of this report.
- Treatment facilities could have permanent visual impacts, including blocking of scenic vistas, new sources of nighttime lighting and buildings out of scale with the area.
- Odors are a concern of every treatment technology and, depending upon type and proximity to residences, will require some measure of treatment.

## 4.10 SUMMARY AND FINE SCREENING OF TREATMENT TECHNOLOGIES

### 4.10.1 Cost Summary

Table 4.19 shows a summary of the construction costs and O&M costs for each treatment alternative.

The apparent low cost alternatives assuming either gravity or STEP collection are:

- Partially Mixed Facultative Ponds
- BIOLAC®
- Oxidation Ditch

These treatment alternatives have the lowest construction cost and comparable O&M costs. Extended aeration MLE, SBR and trickling filters have relatively high construction costs and do not appear to have any significant advantages for operation and maintenance.

Effluent nitrogen limits and tertiary treatment requirements for each disposal/reuse alternative are an important consideration. This will be considered during development of viable project alternatives (Chapter 7).

### 4.10.2 Conceptual Site Layouts

Conceptual site layouts for each of the three apparent low-cost alternatives are shown in the following figures (Figures 4.8, 4.9, and 4.10). The estimated site acreage and main facilities are shown for each alternative.

**Table 4.19 Summary of Treatment Alternative Costs**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | | Treatment Alternative ($M) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Costs[1,2]** | **Extended Aeration MLE** | **BIOLAC®** | **Sequencing Batch Reactor (SBR)** | **Oxidation Ditch** | **Trickling Filters** | **Partially Mixed Facultative Ponds** | **Membrane Bio-Reactor (MBR)** |
| Gravity Collection System | Secondary Treatment Construction Costs | $22.2 | $17.2 | $23.0 | $19.6 | $20.5 | $14.7 | $55.0 |
| | Secondary Treatment O&M Costs | $700,000 | $700,000 | $660,000 | $690,000 | $670,000 | $510,000 | $740,000 |
| | Nitrification Facilities Construction Costs [3,4] | - | - | - | - | $3.8 | $1.0 - 3.8[6] | - |
| | Nitrification Facilities O&M Costs [3,4] | - | - | - | - | $90,000 | $30,000 - $90,000[6] | - |
| | Denitrification Facilities Construction Costs [3] | - | - | - | - | $3.6 | $3.6 | - |
| | Denitrification Facilities O&M Costs [3] | - | - | - | - | $250,000 | $250,000 | - |
| STEP Collection System | Secondary Treatment Construction Costs | $19.1 | $14.2 | $19.4 | $16.5 | $17.6 | $13.7 | N/A |
| | Secondary Treatment O&M Costs | $570,000 | $550,000 | $590,000 | $570,000 | $610,000 | $510,000 | N/A |
| | Nitrification Facilities Construction Costs[3,4] | - | - | - | - | $3.3 | $1.0 - 3.3[6] | - |
| | Nitrification Facilities O&M Costs[3,4] | - | - | - | - | $90,000 | $30,000 - 90,000[6] | - |
| | Denitrification Facilities Construction Costs[3] | $3.6 | $3.6 | $3.6 | $3.6 | $3.6 | $3.6 | $3.6 |
| | Denitrification Facilities O&M Costs[3] | $250,000 | $250,000 | $250,000 | $250,000 | $250,000 | $250,000 | $250,000 |
| Gravity or STEP Collection System | Tertiary Treatment Construction Costs | $1.6 - 3.5 | $1.6 - 3.5 | $1.6 - 3.5 | $1.6 - 3.5 | $1.6 - 3.5 | $2.1 - 4.0[5] | -[7] |
| | Tertiary Treatment O&M Costs | $30,000 - 100,000 | $30,000 - 100,000 | $30,000 - 100,000 | $30,000 - 100,000 | $30,000 - 100,000 | $60,000 - 130,000[5] | -[7] |

N/A - Not Available.

Notes:

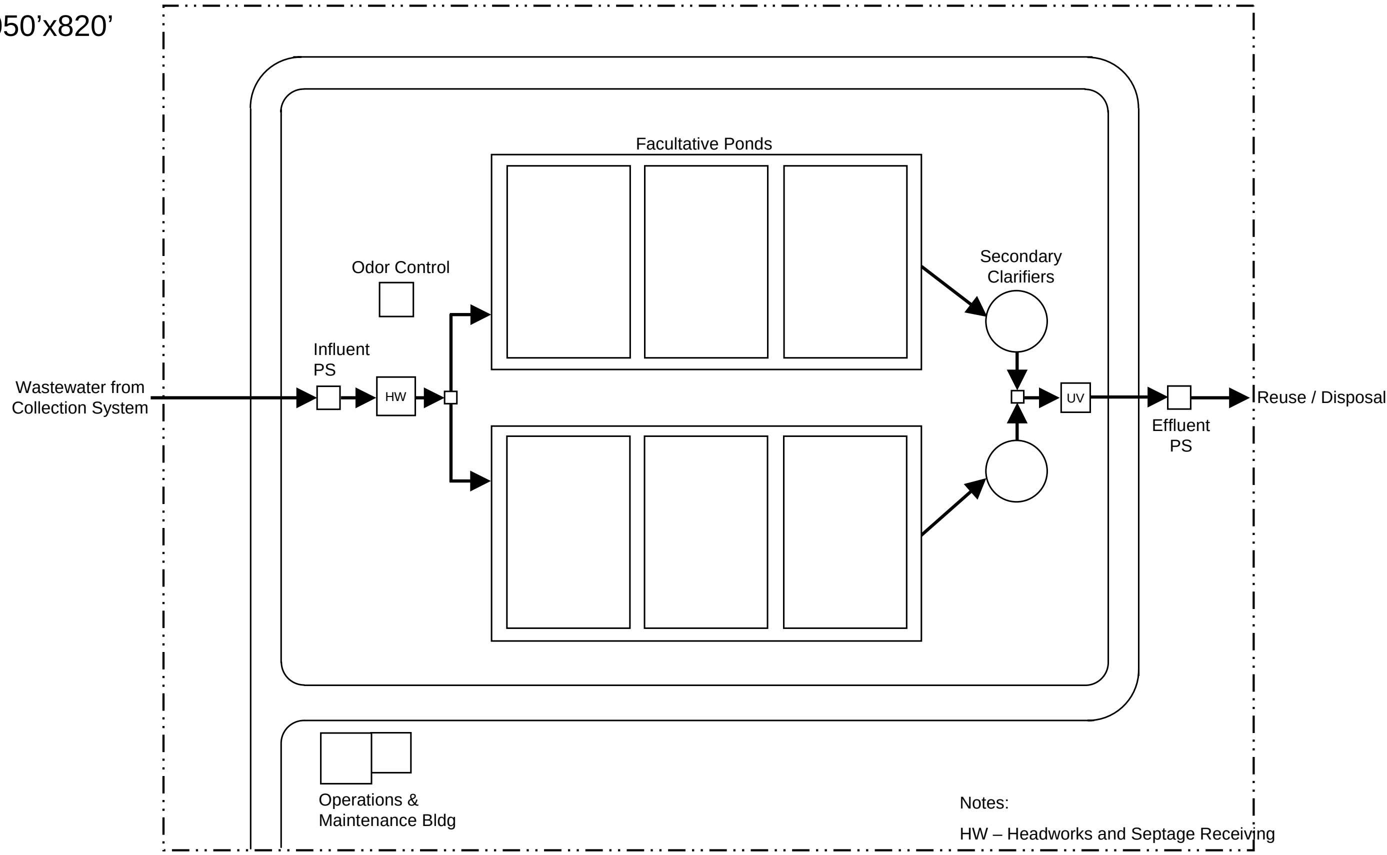
(1) All costs are in April 2007 dollars, based on an ENR of 7879.
(2) Total construction costs do not include design, construction management, and legal/administrative costs. Refer to Chapter 7 for project costs.
(3) Assumed nitrification /denitrification of full plant flow to meet seasonal disposal/ reuse requirements.
(4) Trickling filters and facultative ponds require nitrification upstream of denitrification.
(5) Includes additional pre-treatment costs due to high suspended solids effluent from facultative ponds.
(6) Low costs assume fully nitrifying pond system feasible. High costs assume implementation of nitrifying trickling filters.
(7) MBR effluent quality meets Title 22 requirements without additional treatment.

Partially Mixed Facultative Ponds

20 acres

1,050'x820'

Scale = 1" = 150'




Notes:

HW – Headworks and Septage Receiving

UV – Ultraviolet Disinfection

PS – Pump Station

Solids treatment facilities not included

Tertiary treatment facilities not included

Assumes 50 ft setback on all sides for screening

**Figure 4.9**
**PARTIALLY MIXED FACULATIVE PONDS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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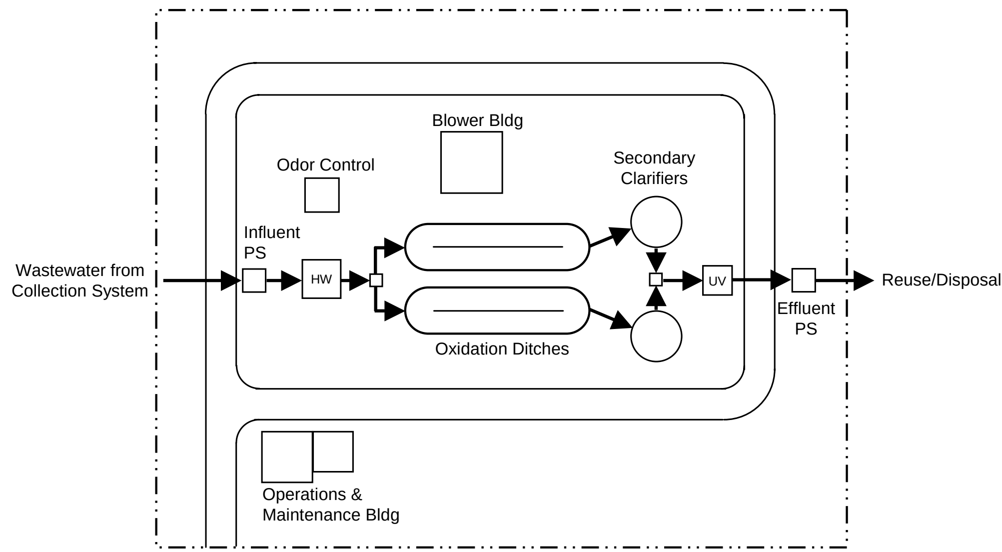
Oxidation Ditch:

8 acres

670’x520’

Scale = 1” = 150’




Notes:

HW – Headworks and Septage Receiving

UV – Ultraviolet Disinfection

PS – Pump Station

Solids treatment facilities not included

Tertiary treatment facilities not included

Assumes 50 ft setback on all sides for screening

**Figure 4.10**
**OXIDATION DITCH**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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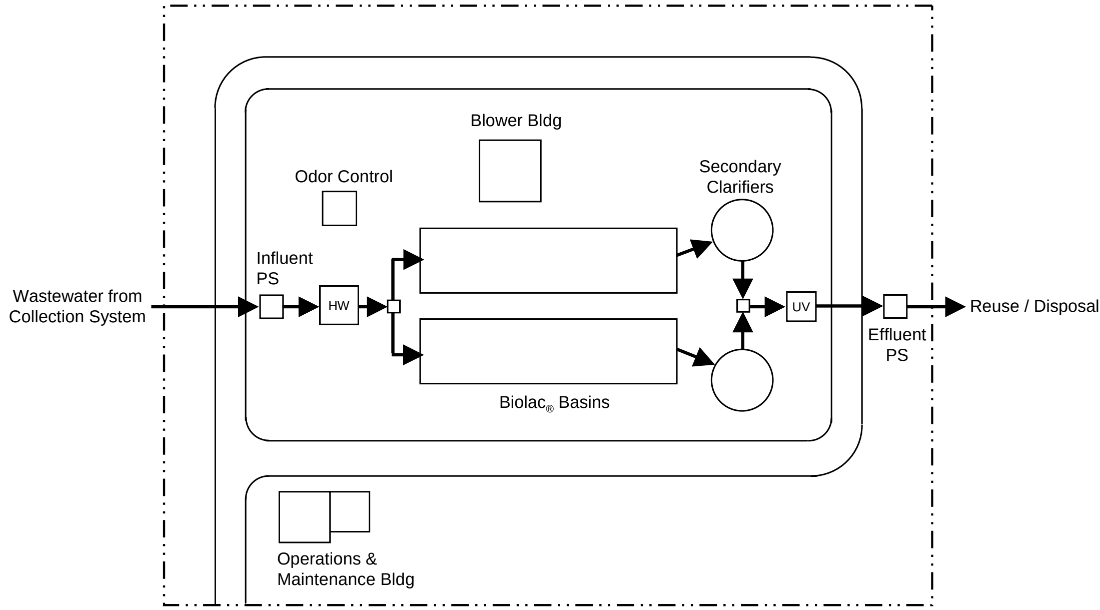
Biolac®

10 acres

750'x580'

Scale = 1" = 150'




Notes:

HW – Headworks and Septage Receiving

UV – Ultraviolet Disinfection

PS – Pump Station

Solids treatment facilities not included

Tertiary treatment facilities not included

Assumes 50 ft setback on all sides for screening

**Figure 4.11**
**BIOLAC**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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# SOLIDS TREATMENT AND DISPOSAL ALTERNATIVES

The Potential Viable Project Alternatives Rough Screening Analysis (Carollo, March 2007) recommended several potentially viable biosolids treatment and disposal alternatives for further evaluation. This included six alternatives for extended secondary treatment (suspended-growth activated sludge) and three similar alternatives for conventional secondary treatment (attached-growth fixed media).

It should be noted that the alternatives presented are not used for partially mixed facultative ponds (advanced wastewater treatment ponds). Biosolids removal from the partially mixed facultative ponds and dewatering prior to disposal is infrequent (every 10 to 20 years). The equipment used to remove and treat the sludge prior to hauling requires mobile and temporary equipment. Therefore, the capital costs for solids treatment associated with partially mixed facultative ponds are negligible (e.g. equipment staging and access).

## 5.1 TREATMENT AND DISPOSAL ALTERNATIVES

Figure 5.1 shows the biosolids treatment and disposal alternatives schematically and how unit processes are configured to produce the level of treatment required. There are five unit processes that can, in some order, be configured to produce Sub-Class B, Class B or Class A biosolids as defined in the rough screening analysis.

### 5.1.1 Sub-Class B Biosolids

This is the solids treatment and disposal alternative planned for the Tri-W Project. Sub-Class B biosolid production includes two unit processes: thickening followed by mechanical dewatering or solar drying. This alternative results in minimal construction of on-site treatment facilities but has relatively high disposal costs due to increased tipping fees charged by off-site facilities. Biosolids hauled to the off-site facilities receive further treatment by a contract operator prior to recycling/disposal. Sub-Class B gives the community the flexibility to add more treatment equipment in the future to upgrade to Class A or B biosolids for hauling or local recycling.

While Sub-Class B biosolids production generally has lower capital and present worth costs, in the California Central Coast area at this time, community goals or anticipation of potential future disposal restrictions may lead the community to select higher levels of treatment in the final viable project alternatives. Class B or Class A treatment alternatives may be implemented with the initial project or in the future by modifying the Sub-Class B treatment process. Capital and O&M costs for all alternatives are provided in this chapter to aid the community in selecting the appropriate alternative for Los Osos though the pro/con analysis.

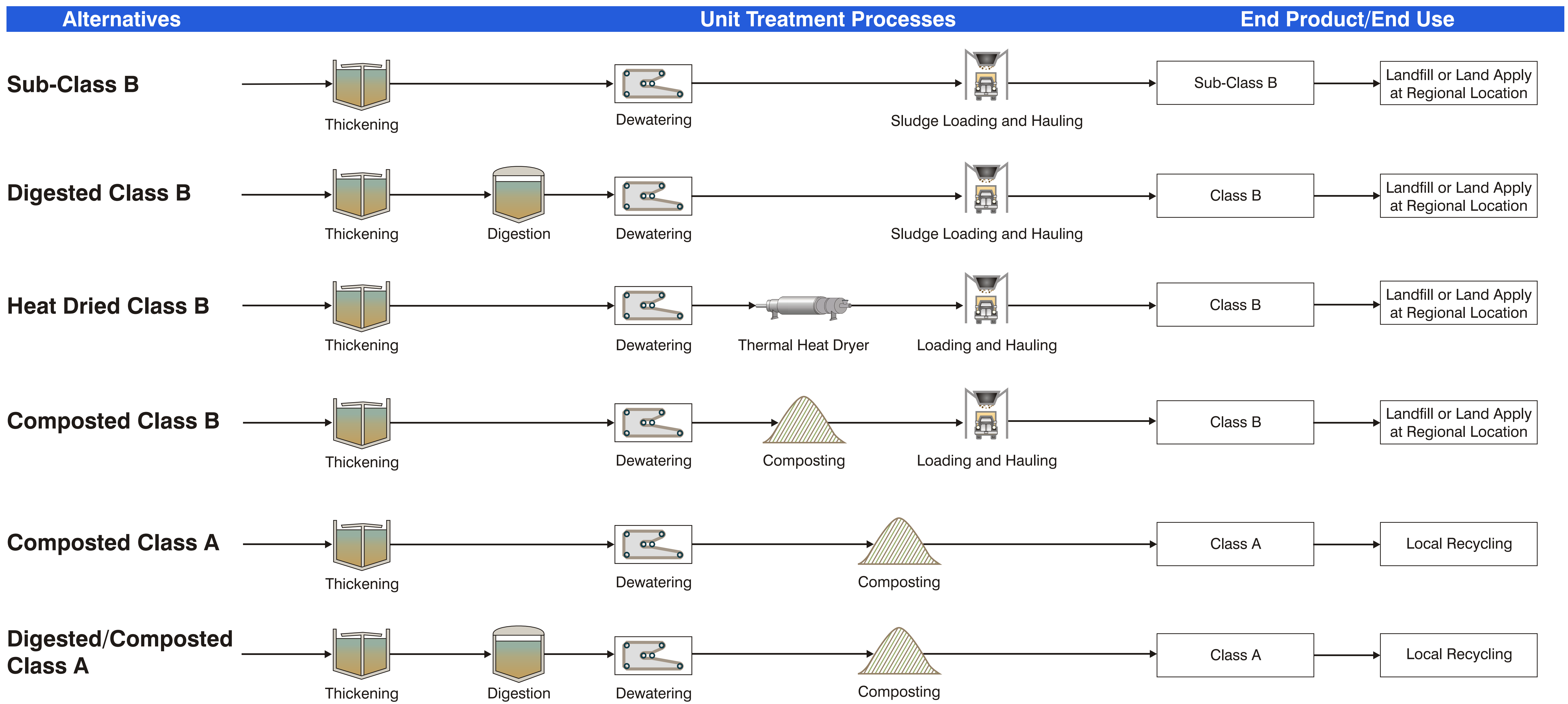


**Figure 5.1**
**SOLIDS TREATMENT AND DISPOSAL ALTERNATIVES**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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### 5.1.2 Digested Class B Biosolids

Digested Class B biosolids is similar to the previous alternative with the addition of a digestion treatment process. Digestion would occur between the thickening and dewatering operations to further stabilize the sludge and reduce the overall volume. The digestion process is assumed to produce Class B biosolids. Class B biosolids have more options for off-site recycling/disposal than Sub-Class B biosolids, however, the capital and operating costs associated with digestion are greater than those costs associated with producing a Sub-Class B biosolids. Digested Class B gives the community the flexibility to add more treatment equipment in the future to upgrade to Class A biosolids for local recycling.

### 5.1.3 Heat Dried Class B Biosolids

Thermal drying to produce heat dried Class B biosolids uses a mechanical dryer instead of a digester. Heat drying occupies a smaller site footprint and facilitates containment of the treatment system for odor control. In the future, should the decision be made to produce Class A biosolids the Class B dryer would need significant modifications and may ultimately entail the purchase of a new dryer. Alternatively, a dryer sized to produce Class A biosolids could be purchased initially, and operated at a reduced level to make Class B biosolids. Then, should the decision be made to produce Class A, a new dryer would not have to be purchased.

### 5.1.4 Composted Class B Biosolids

Composted Class B biosolids expands upon hauling of Sub-Class B biosolids with the addition of a composting process after the dewatering process. The composting process will allow the community to produce Class B biosolids, increasing the hauling options for off-site recycling/disposal.

### 5.1.5 Composted Class A Biosolids

Composted Class A biosolids is similar to the option of composted Class B biosolids. The major differences are the time that the biosolids are required to remain in the composting facility, and the required temperature for composting. This extra time and temperature requirement necessitates only a slightly larger composting facility. The final biosolids product, however, can have been treated to the Class A level. This would allow for the greatest range of options for recycling/disposal of the biosolids including local recycling within the community. If local recycling is pursued, marketability and public acceptance of the biosolids should be investigated as part of the planning process. Additional screening of the biosolids will likely be required to remove the majority of plastics and hair that the public will likely find objectionable.

### 5.1.6 Digested/Composted Class A Biosolids

Digested/composted Class A biosolids are similar to the above recycling option except that digestion is included between the thickening and dewatering operations to further stabilize the sludge and reduce the overall volume. This alternative has the most complex operations requirements and significant capital investment. As with the above recycling option, marketability and public acceptance of the biosolids should be investigated as part of the planning process for local recycling.

## 5.2 TREATMENT FACILITY SOLIDS PRODUCTION

Process modeling of treatment technology options resulted in solids production estimates presented in Table 5.1. Solids production is dependent upon the treatment process selected and the collection system employed. Modeling of the treatment processes for gravity collection influent quality parameters resulted in a solids production rate from the primary and secondary treatment processes ranging from 2,900 to 5,200 pounds per day (dry weight). The average is 4,000 pounds per day.

**Table 5.1 Estimated Treatment Facility Solids Production**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Treatment Technology | Gravity Collection System Estimated Solids Volume (lbs/day dry weight)(1) | STEP/STEG Collection System Estimated Solids Volume (lbs/day dry weight)(2) |
|---|---|---|
| Extended Aeration MLE | 4,200 | 1,100 |
| BIOLAC | 3,500 | 850 |
| Sequencing Batch Reactor (SBR) | 2,900 | 1,000 |
| Oxidation Ditch | 4,100 | 1,100 |
| Trickling Filters | 5,200 | 750 |
| MBR | 4,200 | 1,100 |
| Average(3) | 4,000 | 1,000 |

Notes:
(1) Based on influent loading presented in the Rough Screening Analysis (Carollo, March 2007) and BioTran© process modeling. Includes solids from one septic tank per day.
(2) Based on influent loading presented in the Rough Screening Analysis (Carollo, March 2007) and BioTran© BioTran© process modeling. Includes solids from five septic tanks per day.
(3) Partially mixed facultative ponds not included since treatment facilities are assumed to be mobile and temporary and provided by contract.

Modeling for STEP influent quality resulted in significantly less solids, ranging from 750 to 1,100 pounds per day (dry weight). The average is approximately 1,000 pounds per day.

The actual solids production rate will depend upon which primary and secondary treatment technology is selected and the wastewater treatment plant influent water quality. Gravity collection will convey the solids directly to the treatment plant. The estimated solids volume includes solids from one septic tank per day, assuming tanks outside of the prohibition zone remain in service.

The STEP/STEG collection system reduces the solids loading on the treatment facility, since the septic tanks retain a significant portion of the solid material instead of passing it on to the treatment facility. However, the septic tanks inside the prohibition zone will need to be pumped periodically with septage conveyed to the treatment facility. Septic tanks are assumed to be pumped once every 5 years (approximately 1,000 per year). With approximately 250 working days per year, this results in solids from four septic tanks per day contributing to the total estimated solids volume.

## 5.3 EFFECTS OF STEP/STEG COLLECTION ON CAPITAL AND O&M COSTS

The solids treatment facility capital and O&M costs will be reduced if a STEP/STEG collection system is employed due to the reduced solids loading on the primary and secondary treatment processes. However, the cost reduction will not be linear due to the need for infrastructure, minimum equipment sizing, minimum staffing, etc. For instance, a sludge thickener can handle a range of solids volumes. The same thickener may be applicable to both the gravity and STEP/STEG systems. Half the solids volume may lead to a 10 to 20 percent decrease in the overall size of the facility to house the equipment.

The amount of time required for an operator to start-up and shutdown a piece of equipment as well as the time required to perform maintenance is not proportional to the size of the equipment. The amount of polymer used and the amount of electricity consumed to operate the equipment will decrease, perhaps linearly with the solids volume.

It is difficult to establish a concrete relationship between the reduction in solids volume and capital and O&M cost reduction. However, preliminary analysis shows a reduction of 20 to 40 percent in O&M costs and capital costs for a solids treatment facility with a 75 percent reduction in influent solids volume. A range of capital and O&M costs are presented throughout this chapter to estimate the effect of reduced solids volume for a STEP/STEG collection system.

## 5.4 UNIT TREATMENT PROCESS COST DEVELOPMENT

This section details the process that was used to develop costs for the various unit processes under consideration. The unit processes are as follows:

- Thickening (of Waste Activated Sludge)
- Dewatering
- Digestion
- Heat Drying
- Composting

# 5.5 THICKENING

## 5.5.1 Technology Options

Waste activated sludge (WAS) thickening is necessary as the first step in treatment for all of the treatment and disposal alternatives to remove excess water and reduce required downstream process capacity. WAS thickening options will increase solids content from near 1 percent from the secondary clarifier underflow to approximately 4 percent. WAS thickening options include dissolved air flotation, gravity belt thickening, and rotary drum thickening.

### 5.5.1.1 *Dissolved Air Flotation*

A dissolved air flotation (DAF) thickener forces liquid-solids separation with introduction of fine bubbles to float solids to the surface. Surface skimmers collect the thickened, floated solids and bottom assemblies collect settleable solids.

### 5.5.1.2 *Gravity Belt Thickening*

A gravity belt thickener (GBT) collects solids by draining the excess water from settled secondary sludge through a moving fabric belt. GBTs typically require minimal space and power usage, but rely on chemical polymer addition to achieve higher solids recovery.

### 5.5.1.3 *Rotary Drum Thickening*

A rotary drum thickener (RDT) consists of a floc development tank, driven impeller, multiple-stage rotary drum with filtration media (woven wire mesh), supporting frame, spray deflection covering, spray wash header, and return water collection tank. In the rotary drum screen, the liquid separates from the flocculated solids through the woven wire mesh, is collected in the return water tank, and exits through a drain in the bottom.

#### 5.5.1.4 *Assumed Technology for Cost Evaluation*

Gravity belt thickeners are assumed as the preferred unit process for WAS thickening. GBTs are assumed over dissolved air flotation and rotary drum thickeners due to the ease of operation, lower maintenance costs, low consumption of electricity and low noise.

### 5.5.2 Cost Basis

The cost basis for thickening is based on master planning efforts for a similar sized facility in Morro Bay, CA. The unit cost development is summarized in Table 5.2. The average unit capital cost to install a thickening process is approximately $500,000 per million gallons of WWTP influent. The upper range per unit capital cost depending on the thickening option is approximately $600,000 per million gallons of influent.

**Table 5.2 Unit Cost Estimate for Thickening**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Morro Bay/Cayucos WWTP(1,2) |
|---|---|---|
| Facility Capacity | mgd | 1.5 |
| Estimated Construction Cost | $ | 700,000 - 900,000 |
| Estimated O&M Cost(3) | $/year | 180,000 - 200,000 |
| Unit Capital Cost Basis | $/mgd | 500,000 - 600,000 |
| Unit O&M Cost Basis | $/year per mgd | 120,000 - 130,000 |

Notes:
(1) Based on Morro Bay/Cayucos Sanitation District Wastewater Treatment Facility Master Plan, 2007.
(2) All costs are in April 2007 dollars.
(3) Includes labor, power, chemicals, and maintenance.

The unit costs to operate and maintain the thickening process ranged from an average of $120,000 to an estimated upper-end cost of $130,000 per million gallons of WWTP influent.

Using the estimated unit cost information presented above, Table 5.3 shows the estimated construction and O&M costs for a wastewater treatment facility in Los Osos.

Assuming gravity collection, the estimated construction cost for thickening at a Los Osos facility ranges between $900,000 and $1,100,000.

Assuming a 20 to 40 percent reduction in capital costs if a STEP/STEG collection system is employed, the estimated construction cost for thickening at a Los Osos facility ranges from $520,000 to $780,000.

Using the estimated unit cost range and assuming gravity collection, the O&M cost range for thickening at a facility is between $170,000 and $180,000 per year.

| Table 5.3 | Estimated Construction and O&M Costs for Thickening[1] Los Osos Wastewater Project Development San Luis Obispo County |
|---|---|

| | Units | Los Osos Wastewater Treatment Facility |
|---|---|---|
| Facility Capacity | mgd | 1.4 (Gravity)/1.2 (STEP/STEG) |
| Subtotal Construction Cost | | |
| Gravity Collection | $ | 700,000 - 850,000 |
| STEP/STEG Collection | $ | 400,000 - 600,000[3] |
| Contingency 30% | | |
| Gravity Collection | $ | 200,000 - 250,000 |
| STEP/STEG | $ | 120,000 - 180,000 |
| Total Construction Cost[2] | $ | |
| Gravity Collection | $ | 900,000 - 1,100,000 |
| STEP/STEG | $ | 500,000[3] - 800,000[3] |
| Estimated O&M Cost | | |
| Gravity Collection | $/year | 170,000 - 180,000 |
| STEP/STEG Collection | $/year | 90,000 - 130,000[3] |

Notes:
(1) All costs have been adjusted to February 2007 dollars, using the Engineering News Report Construction Cost Index (ENR CCI).
(2) Total construction costs do not include design, construction management, and legal/administrative costs.
(3) Based on a 20 to 40 percent reduction in costs for reduced solids loading with a STEP/STEG collection system.

Again, assuming a 20 to 40 percent reduction in O&M costs if a STEP/STEG collection system is employed, the estimated O&M costs range from $90,000 to $130,000 per year.

## 5.6 DEWATERING

### 5.6.1 Technology Options

Dewatering is necessary to remove as much water as possible from the biosolids before hauling or transporting for disposal/reuse, composting and/or drying. Dewatering options will increase solids content to between approximately 18 to 20 percent from mechanical dewatering options to 70 percent or better from solar drying. The options considered for Los Osos are described below.

#### 5.6.1.1 *Belt Filter Press*

A belt filter press (BFP) is a mechanical method of removing water from thickened or digested sludge. It uses a filter cloth belt that is fed in a serpentine pattern between rollers of decreasing diameter and spacing. As the sludge is passed between the rollers, water is squeezed from the sludge. Chemical conditioning is usually employed to increase the effectiveness of the process.

#### 5.6.1.2 *Centrifugation*

A centrifuge is another mechanical dewatering process that could be installed to attain similar or higher solids content cake with a smaller equipment footprint compared to a BFP. The installation would need to be housed in a solids handling building to reduce noise and contain odors. Centrifuges are relatively energy intense.

#### 5.6.1.3 *Solar Drying Bed*

Solar drying systems can be constructed on asphalt or concrete pads. Solar drying beds are capable of producing biosolids with generally at least 70 percent solids content. Solar drying beds can produce odors, especially when not preceded by digestion.

#### 5.6.1.4 *Assumed Technology for Cost Evaluation*

Solar drying beds are assumed for mechanical dewatering due to the relatively low capital and O&M costs for a small wastewater treatment facility compared to centrifugation. Solar drying beds also have several advantages over mechanical dewatering if sufficient space is available.

### 5.6.2 Cost Basis

The cost basis for dewatering is based on master planning efforts for Morro Bay, CA and design estimates for Coachella, CA Water Reclamation Plants (WRP) 4, 7 and 10. Unit cost development is summarized in Table 5.4.

**Table 5.4 Unit Cost Estimate for Dewatering**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Morro Bay/ Cayucos WWTP[1,3] Mechanical Dewatering | Coachella WRP 4/7/10[2,4] Solar Drying |
|---|---|---|---|
| Facility Capacity | mgd | 1.5 | 24.0 |
| Estimated Construction Cost | $ | 1,400,000 - 1,800,000 | 13,600,000 - 16,900,000 |
| Estimated O&M Cost[5] | $/year | 280,000 - 310,000 | 1,200,000 - 1,600,000 |
| Unit Capital Cost Basis | $/mgd | 900,000 - 1,200,000 | 600,000 - 700,000 |
| Unit O&M Cost Basis | $/year per mgd | 190,000 - 210,000 | 50,000 - 70,000 |

Notes:
(1) Based on Morro Bay/Cayucos Sanitation District Wastewater Treatment Facility Master Plan, 2007.
(2) Based on Coachella Valley Water District Biosolids Management Plan Update, December 2006.
(3) All costs are in January 2007 dollars.
(4) All costs are in December 2006 dollars.
(5) Includes labor, power, chemicals, and maintenance.

The average unit capital cost to install a mechanical dewatering process is approximately $900,000 per million gallons of WWTP influent. The upper range per unit capital cost is approximately $1,200,000 per million gallons of influent.

The average and upper range cost to install a solar drying dewatering process is approximately $600,000 to $700,000 per million gallons of WWTP influent, respectively. Due to the economy of scale for the larger Coachella facilities, solar drying for the Los Osos facility will likely be near or over the upper end of this range.

The unit costs to operate and maintain the mechanical dewatering process ranged from an average of $190,000 to an upper cost of $210,000 per million gallons per year of WWTP influent.

The average annual cost to operate and maintain a solar drying dewatering facility ranged from $50,000 to an upper cost of $70,000 per million gallons of WWTP influent.

Using the estimated unit cost information developed above, Table 5.5 shows the estimated construction and O&M costs for a wastewater treatment facility in Los Osos.

**Table 5.5 Estimated Construction and O&M Costs for Dewatering(1)**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Los Osos Wastewater Treatment Facility | |
|---|---|---|---|
| Facility Capacity | mgd | 1.4 (Gravity)/1.2 (STEP/STEG) | |
| | | Mechanical Dewatering | Solar Drying |
| Subtotal Construction Cost | | | |
| Gravity Collection | $ | 1,300,000 - 1,700,000 | 800,000 - 1,000,000 |
| STEP/STEG Collection | $ | 700,000 - 1,200,000(2) | 400,000 - 700,000(2) |
| Contingency 30% | | | |
| Gravity Collection | $ | 390,000 - 510,000 | 240,000 - 300,000 |
| STEP/STEG | $ | 210,000 - 360,000 | 120,000 - 210,000 |
| Total Construction Cost(3) | $ | | |
| Gravity Collection | $ | 1,700,000 - 2,200,000 | 1,000,000 - 1,300,000 |
| STEP/STEG | $ | 900,000 - 1,600,000(2) | 500,000 - 900,000(2) |
| Estimated O&M Cost | | | |
| Gravity Collection | $/year | 270,000 - 290,000 | 70,000 - 100,000 |
| STEP/STEG Collection | $/year | 140,000 - 200,000(2) | 40,000 - 70,000(2) |

Notes:
(1) All costs have been adjusted to February 2007 dollars, using the ENR CCI.
(2) Based on a 20 to 40% reduction in costs for reduced solids loading with a STEP/STEG collection system.
(3) Total construction costs do not include design, construction management, and legal/administrative costs.

Using the estimated unit cost range and assuming gravity collection, the estimated construction cost of mechanical dewatering for a Los Osos facility ranges between $1,700,000 and $2,200,000. The estimated construction cost of solar drying ranges between $1,000,000 and $1,300,000.

Assuming a 20 to 40 percent reduction in capital costs if a STEP/STEG collection system is employed, the estimated construction cost ranges from $900,000 to $1,600,000 for mechanical dewatering and $500,000 to $900,000 for solar drying.

Using the estimated unit cost range and assuming gravity collection, the O&M cost range for mechanical dewatering at a facility is between $270,000 and $290,000 per year. The O&M cost range for solar drying is between $70,000 and $100,000 per year.

Again, assuming a 20 to 40 percent reduction in O&M costs if a STEP/STEG collection system is employed, the estimated O&M costs range from $140,000 to $200,000 for mechanical dewatering and $40,000 to $70,000 for solar drying.

## 5.7 DIGESTION OPTIONS

### 5.7.1 Technology Options

Digestion is the most common solids treatment method for meeting Class B or Class A biosolids requirements. Digestion biologically reduces the amount of volatile solids (VS) in the sludge and reduces the pathogen content. The primary digestion alternatives applicable for the community facility include aerobic digestion, auto-thermal thermophilic aerobic digestion (ATAD), and anaerobic digestion.

The level of treatment provided by digestion varies by time and temperature for VS and pathogen destruction. Class A biosolids production requires elevated temperatures and/or longer hydraulic retention time (HRT) compared to Class B requirements, to achieve a higher level of pathogen destruction. Numerous variations to typical digestion processes are available. Some of the most common variations include aerobic digestion followed by anaerobic digestion and multi-temperature treatment phasing.

#### 5.7.1.1 *Aerobic Digestion*

Conventional aerobic digestion involves using multiple digester tanks for sludge stabilization. The digesters are not insulated, operate at ambient temperatures of 15 to 20 degrees Celsius, are provided with sufficient diffused air to maintain aerobic and completely mixed conditions, and have a HRT of 40 to 60 days to meet Class B pathogen reduction requirements. Conventional aerobic digestion alone is not acceptable to produce Class A biosolids. To produce Class A biosolids, the biosolids must be heated for a specific duration, or a process to significantly reduce pathogens (thermal drying, composting, etc.) must be added after digestion.

#### 5.7.1.2 *Auto-Thermal Thermophilic Aerobic Digestion (ATAD)*

ATAD is a form of aerobic digestion operating at higher temperatures (55 to 60 degrees Celsius) to produce Class A biosolids.

#### 5.7.1.3 *Anaerobic Digestion*

Conventional mesophilic anaerobic digestion involves using digester tanks for sludge stabilization. The digester is insulated, operates at increased temperatures of 37 degrees Celsius, and has a hydraulic residence time (HRT) of 15 days or more. Boilers and heat exchangers are required to heat the digester contents to attain mesophilic temperatures. This process destroys volatile solids in the absence of oxygen and reduces pathogens to produce Class B biosolids.

#### 5.7.1.4 *Assumed Technology for Cost Evaluation*

Anaerobic digestion generally has the highest total annual cost due to the high construction cost. Aerobic digestion and ATAD generally have comparable total annual costs. ATAD has a lower capital cost, but higher O&M costs. Based on a likely lower life cycle cost basis and ease of operation, aerobic digestion is assumed for solids treatment alternatives requiring digestion.

### 5.7.2 Cost Basis

The capital and O&M costs for digestion are based on work previously completed for Coachella, CA at Water Reclamation Plants 4, 7 and 10. Unit cost development is summarized in Table 5.6. The average unit capital cost to install an aerobic digestion system ranges from approximately $800,000 to $1,500,000 per million gallons of WWTP influent. Due to the economy of scale for the larger Coachella facilities, aerobic digestion for the Los Osos facility would likely be near or over the upper end of this range.

The unit costs to operate and maintain the aerobic digestion process range from approximately $30,000 per million gallons of WWTP influent to $35,000 per million gallons.

Using the estimated unit cost information developed above, Table 5.7 shows the estimated construction and O&M costs for digestion at a wastewater treatment facility in Los Osos.

**Table 5.6 Unit Cost Estimate for Digestion**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Coachella WRP 4[1,2] Aerobic Digestion | Coachella WRP 7[1,2] Aerobic Digestion | Coachella WRP 10[1,2] Aerobic Digestion |
|---|---|---|---|---|
| Facility Capacity | mgd | 2.9 | 6.1 | 15.2 |
| Estimated Construction Cost | $ | 4,400,000 | 6,600,000 | 12,500,000 |
| Estimated O&M Cost[3] | $/year | 100,000 | 210,000 | 500,000 |
| Unit Capital Cost Basis | $/mgd | 1,500,000 | 1,100,000 | 800,000 |
| Unit O&M Cost Basis | $/year per mgd | 35,000 | 35,000 | 30,000 |

Notes:
(1) Based on Coachella Valley Water District Biosolids Management Plan Update, December 2006.
(2) All costs are in December 2006 dollars.
(3) Includes labor, power, and maintenance.

**Table 5.7 Estimated Construction and O&M Costs for Digestion[1]**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Los Osos Wastewater Treatment Facility |
|---|---|---|
| Facility Capacity | mgd | 1.4 (Gravity)/1.2 (STEP/STEG) |
| Subtotal Construction Cost | | |
| Gravity Collection | $ | 2,100,000[2] |
| STEP/STEG | $ | 1,100,000 - 1,400,000[3] |
| Contingency 30% | | |
| Gravity Collection | $ | 630,000 |
| STEP/STEG | $ | 330,000 - 420,000 |
| Total Construction Cost[4] | | |
| Gravity Collection | $ | 2,700,000[2] |
| STEP/STEG Collection | $ | 1,400,000 - 1,800,000[3] |
| Estimated O&M Cost | | |
| Gravity Collection | $/year | 50,000[2] |
| STEP/STEG Collection | $/year | 25,000 - 35,000[3] |

Notes:
(1) All costs have been adjusted to February 2007 dollars, using the ENR CCI.
(2) Based on the upper value of the unit cost range due to economy of scale for the reference facilities.
(3) Based on a 20 to 40% reduction in costs for reduced solids loading with a STEP/STEG collection system.
(4) Total construction costs do not include design, construction management, and legal/administrative costs.

Assuming gravity collection, the estimated construction cost of aerobic digestion for a Los Osos facility ranges between $1,500,000 and $2,700,000. Again, due to the economy of scale for the larger Coachella facilities, aerobic digestion for the Los Osos facility would likely be near the upper end of this range. Therefore, $2,700,000 will be the assumed value for construction of aerobic digestion at the Los Osos facility assuming gravity collection.

Assuming a 20 to 40 percent reduction in capital costs if a STEP/STEG collection system is employed, the estimated construction cost ranges from $1,400,000 to $1,800,000 for aerobic digestion.

Using the estimated unit cost range and assuming gravity collection, the O&M cost for aerobic digestion at a facility is approximately $50,000 per year.

Again, assuming a 20 to 40 percent reduction in O&M costs if a STEP/STEG collection system is employed, the estimated O&M costs range from $25,000 to $35,000 for aerobic digestion.

## 5.8 HEAT DRYING OPTIONS

### 5.8.1 Technology Options

Heat drying is a solids treatment process used to produce Class A or Class B biosolids in the form of dried pellets for either agricultural/horticultural uses or as a carbon neutral fuel. Heat drying uses mechanical agitation and auxiliary heat to increase the water evaporation rate from the biosolids. The primary heat drying alternatives include direct and indirect dryers.

#### 5.8.1.1 *Direct Dryers*

Direct dryers use a furnace to produce heat used for drying. The heat produced in the furnace is blown through a drum that tumbles the biosolids, similar to a regular clothes dryer. The wet cake from the dewatering process is transported into the drum of the direct dryer. Biosolids are tumbled within the drum as hot air from the furnace is blown into the drum with the tumbling biosolids to evaporate moisture from the biosolids.

#### 5.8.1.2 *Indirect Dryers*

Indirect dryers heat mediums, such as oil or water, and use them to heat metal surfaces. Only the metal surfaces come in contact with the wet solids and heat the solids to evaporation temperature by conduction.

#### 5.8.1.3 *Assumed Technology for Cost Evaluation*

Indirect dryers are significantly less expensive than direct dryers, but do not produce the high-quality product that the direct dryer produces. Therefore, due to cost considerations only indirect drying is assumed as the preferred unit process for heat drying.

### 5.8.2 Cost Basis – Capital

The capital and O&M costs for heat drying are based on work previously performed for Coachella, CA at WRPs 4, 7 and 10. Unit cost development is summarized in Table 5.8. The average unit capital cost to install an indirect heat drying system ranges from approximately $600,000 to $1,600,000 per million gallons of WWTP influent. Due to the economy of scale for the larger Coachella facilities, heat drying for the Los Osos facility would likely be near or over the upper end of this range. In addition, a limited size selection of heat dryers makes scaling of the reference costs difficult.

**Table 5.8 Unit Cost Estimate for Heat Drying**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Coachella WRP 4[1,2] Indirect Heat Drying | Coachella WRP 7[1,2] Indirect Heat Drying | Coachella WRP 10[1,2] Indirect Heat Drying |
|---|---|---|---|---|
| Facility Capacity | mgd | 2.9 | 6.1 | 15.2 |
| Estimated Construction Cost | $ | 4,700,000 | 5,200,000 | 9,500,000 |
| Estimated O&M Cost[3] | $/year | 240,000 | 320,000 | 560,000 |
| Unit Capital Cost Basis | $/mgd | 1,600,000 | 900,000 | 600,000 |
| Unit O&M Cost Basis | $/year per mgd | 80,000 | 50,000 | 40,000 |

Notes:
(1) Based on Coachella Valley Water District Biosolids Management Plan Update, December 2006.
(2) All costs are in December 2006 dollars.
(3) Includes labor, power, and maintenance.

The unit costs to operate and maintain the process range from approximately $40,000 per million gallons to $80,000 per million gallons of WWTP influent.

Using the estimated unit cost information developed above, Table 5.9 shows the estimated construction and O&M costs for a wastewater treatment facility in Los Osos. Assuming gravity collection, the estimated construction cost of aerobic digestion for a Los Osos facility ranges between $1,100,000 and $2,900,000. Due to the economy of scale for the larger Coachella facilities, indirect heat drying for the Los Osos facility would likely be near the upper end of this range. Therefore, $2,900,000 will be the assumed value for construction of indirect heat drying at the Los Osos facility assuming gravity collection.

| Table 5.9 | Estimated Construction and O&M Costs for Heat Drying[1]<br>Los Osos Wastewater Project Development<br>San Luis Obispo County | |
|---|---|---|
| | **Units** | **Los Osos Wastewater Treatment Facility** |
| Facility Capacity | mgd | 1.4 (Gravity)/1.2 (STEP/STEG) |
| Construction Cost | | |
| Gravity Collection | $ | 2,200,000[2] |
| STEP/STEG Collection | $ | 1,200,000 - 1,500,000[3] |
| Contingency 30% | | |
| Gravity Collection | $ | 660,000 |
| STEP/STEG Collection | $ | 360,000 - 450,000 |
| Total Construction Cost[4] | | |
| Gravity Collection | $ | 2,900,000[2] |
| STEP/STEG Collection | $ | 1,600,000 - 2,000,000[3] |
| Estimated O&M Cost | | |
| Gravity Collection | $/year | 110,000[2] |
| STEP/STEG Collection | $/year | 60,000 - 80,000[3] |

Notes:
(1) All costs have been adjusted to February 2007 dollars, using the ENR CCI.
(2) Based on the upper value of the unit cost range due to economy of scale for the reference facilities.
(3) Based on a 20 to 40 percent reduction in costs for reduced solids loading with a STEP/STEG collection system.
(4) Total construction costs do not include design, construction management, and legal/administrative costs.

Assuming a 20 to 40 percent reduction in capital costs if a STEP/STEG collection system is employed, the estimated construction cost ranges from $1,600,000 to $2,000,000 for indirect heat drying.

Using the estimated unit cost range and assuming gravity collection, the O&M cost for indirect heat drying at a facility is approximately $110,000 per year.

Again, assuming a 20 to 40 percent reduction in O&M costs if a STEP/STEG collection system is employed, the estimated O&M costs range from $60,000 to $80,000 for indirect heat drying.

## 5.9 COMPOSTING OPTIONS

### 5.9.1 Technology Options

The basic concept of composting is to bulk the dewatered biosolids with a high carbon source such as wood chips or green waste, and under controlled aerobic conditions break down the organic matter while generating sufficient heat to kill pathogens. Dewatered biosolids are too wet for composting without a bulking agent to lower the overall percent moisture content and improve the carbon to nitrogen ratio and allow for air penetration into the compost pile.

Onsite composting can be broken down into three main styles:

- Windrow composting
- In-vessel composting
- Aerated static pile composting

Each style represents a tradeoff of capital versus operation and maintenance expenses, and one style may be more manageable and neighbor friendly than another. Odors can be significant at even a well-managed composting facility, and need to be considered when siting a facility.

#### 5.9.1.1 *Windrow Composting*

The dewatered biosolids are mixed with the bulking agent and laid out in the composting facility in long rows, called windrows. These windrows can be as high as seven feet tall. It can be difficult to maintain consistent aerobic conditions throughout the cross section of the windrow. The windrows must be turned over and mixed during the composting period. This is to ensure that all of the biosolids are exposed to aerobic conditions and the appropriate temperature.

#### 5.9.1.2 *In-Vessel Composting*

In-vessel composting is accomplished inside a closed container. The dewatered biosolids /bulking material mixture is kept aerated by air blowers and ventilation piping. Depending upon the specific type of in-vessel composter, it may be equipped with a mixer. While an in-vessel composting facility will be faster and have fewer odors, it is more expensive to construct than either of the other two composting options.

#### 5.9.1.3 *Aerated Static Pile (ASP) Composting*

An aerated static pile is similar to a windrow. The major differences between the two are that the ASP will be taller, covered with screened compost and have aeration piping at the base of the pile to force air through the pile.

#### 5.9.1.4 *Assumed Technology for Cost Evaluation*

Windrow composting is the least expensive of the three options to construct and gives the community the ability to produce either Class A or B biosolids. Therefore, windrow composting is assumed as the preferred unit process for composting.

### 5.9.2 Cost Basis

The capital and O&M costs for composting are based on work previously performed for Coachella, CA at WRPs 4 and 7. Unit cost development is summarized in Table 5.10. The average unit capital cost to install a windrow composting system ranges from approximately $400,000 to $600,000 per million gallons of WWTP influent. Due to the economy of scale for the larger Coachella facilities, composting for the Los Osos facility would likely be near the upper end of this range.

**Table 5.10 Unit Cost Estimate for Composting**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Units | Coachella WRP 4[1,2] Windrow Composting | Coachella WRP 7[1,2] Windrow Composting | Coachella WRP 4 & 10[1,2] Windrow Composting |
|---|---|---|---|---|
| Facility Capacity | mgd | 24.2 | 6.1 | 18.0 |
| Estimated Construction Cost | $ | 12,000,000 | 2,500,000 | 10,500,000 |
| Estimated O&M Cost[3] | $/year | 2,600,000 | 550,000 | 2,300,000 |
| Unit Capital Cost Basis | $/mgd | 500,000 | 400,000 | 600,000 |
| Unit O&M Cost Basis | $/year per mgd | 110,000 | 90,000 | 130,000 |

Notes:
(1) Based on Coachella Valley Water District Biosolids Management Plan Update, December 2006.
(2) All costs are in December 2006 dollars.
(3) Includes labor, power, and maintenance.

The unit costs to operate and maintain the process range from approximately $90,000 per million gallons of WWTP influent to $130,000 per million gallons.

Using the estimated unit cost information developed above, Table 5.11 shows the estimated construction and O&M costs for a wastewater treatment facility in Los Osos.

Assuming gravity collection, the estimated construction cost of windrow composting for a Los Osos facility ranges between $700,000 and $1,000,000. Due to the economy of scale for the larger Coachella facilities, windrow composting for the Los Osos facility would likely be near the upper end of this range. Therefore, $1,000,000 will be the assumed value for construction of windrow composting at the Los Osos facility assuming gravity collection.

Assuming a 20 to 40 percent reduction in capital costs if a STEP/STEG collection system is employed, the estimated construction cost ranges from $500,000 to $800,000 for windrow composting.

Using the estimated unit cost range and assuming gravity collection, the O&M cost for windrow composting at a facility is approximately $180,000 per year.

Again, assuming a 20 to 40 percent reduction in O&M costs if a STEP/STEG collection system is employed, the estimated O&M costs range from $100,000 to $130,000 for windrow composting.

**Table 5.11 Estimated Construction and O&M Costs for Composting[1]**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | **Units** | **Los Osos Wastewater Treatment Facility** |
|---|---|---|
| Facility Capacity | mgd | 1.4 (Gravity)/1.2 (STEP/STEG) |
| Estimated Construction Cost | | |
| Gravity Collection | $ | 800,000[2] |
| STEP/STEG Collection | $ | 400,000 - 600,000[3] |
| Contingency 30% | | |
| Gravity Collection | $ | 240,000 |
| STEP/STEG Collection | $ | 120,000 - 180,000 |
| Total Construction Cost[4] | | |
| Gravity Collection | $ | 1,000,000[2] |
| STEP/STEG Collection | $ | 500,000- 800,000[3] |
| Estimated O&M Cost | | |
| Gravity Collection | $/year | 180,000[2] |
| STEP/STEG Collection | $/year | 100,000 – 130,000[3] |

Notes:
(1) All costs have been adjusted to February 2007 dollars, using the ENR CCI.
(2) Based on the upper value of the unit cost range due to economy of scale for the reference facilities.
(3) Based on a 20 to 40% reduction in costs for reduced solids loading with a STEP/STEG collection system.
(4) Total construction costs do not include design, construction management, and legal/administration costs.

## 5.10 BIOSOLIDS HAULING COSTS

Table 5.12 summarizes the amount of sludge produced per year for an average solids production volume of 4,000 pounds per day (dry weight) for a gravity collection system. Actual sludge production will depend on the treatment technology employed. However, the average value will provide an approximation and allow each solids treatment alternative to be evaluated for comparison purposes. Based on the biosolids production for each solids treatment alternative, hauling costs are provided for inclusion in the annual O&M costs. Although the two Class A biosolids alternatives show no cost to dispose of the biosolids, there will be some small cost incurred. Also, once the community completes its market analysis on selling Class A biosolids, there may be a small source of income that will offset the transportation costs.

Table 5.13 provides the same information for a STEP/STEG collection system with an average solids production volume of 1,000 pounds per day (dry weight). The average value will provide an approximation and allow each solids treatment alternative to be evaluated for comparison purposes. Based on the biosolids production for each solids treatment

**Table 5.12 Biosolids Production and Hauling Costs for Gravity Collection**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Treatment Alternative Effluent Solids (%) | Biosolids Hauled Offsite (tons/year)(1) | Disposal Cost ($/year)(2) |
|---|---|---|---|
| Sub-Class B Biosolids | 18 | 4,056 | 190,000 |
| Digested Class B Biosolids | 20 | 3,103 | 130,000 |
| Heat Dried Class B Biosolids | 70 | 1,043 | 44,000 |
| Composted Class B Biosolids | 50 | 1,460 | 61,000 |
| Composted Class A Biosolids | 55 | 1,327 | 0[3] |
| Digested/ Composted Class A Biosolids | 55 | 1,128 | 0[3] |

Notes:
(1) Based on an average solids volume from primary and secondary treatment process of 4,000 pounds per day (dry weight).
(2) Based on a hauling and tipping fee at San Joaquin Composting facility of $42 per ton for Class B biosolids and $46 per ton for Sub-Class b biosolids.
(3) Onsite recycling assumed.

**Table 5.13 Biosolids Production and Hauling Costs for STEP/STEG Collection**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Treatment Alternative Effluent Solids (%) | Biosolids Hauled Offsite (tons/year) (1) | Disposal Cost ($/year)(2) |
|---|---|---|---|
| Sub-Class B Biosolids | 18 | 1,014 | 47,000 |
| Digested Class B Biosolids | 20 | 776 | 33,000 |
| Heat Dried Class B Biosolids | 70 | 261 | 11,000 |
| Composted Class B Biosolids | 50 | 365 | 15,000 |
| Composted Class A Biosolids | 55 | 332 | 0(3) |
| Digested/ Composted Class A Biosolids | 55 | 282 | 0(3) |

Notes:
(1) Based on an average solids volume from primary and secondary treatment process of 1,000 pounds per day (dry weight). Includes biosolids from STEP tank septage processed by the treatment plant.
(2) Based on a hauling and tipping fee at San Joaquin Composting facility of $42 per ton for Class B biosolids and $46 per ton for Sub-Class b biosolids.
(3) Local recycling assumed.

alternative, hauling costs are provided for inclusion in the annual O&M costs. Although the two Class A biosolids alternatives show no cost to dispose of the biosolids, there will be some small cost incurred.

Transport would be provided by dedicated biosolids and other organics transportation equipment. Trucks are generally enclosed, covered long-bed trailers with a 40,000 pound capacity. Equipment is specially designed for reliably transporting biosolids. Using approximately 250 working days per year, hauling of sub-class B biosolids would require 4 trucks per week for a gravity collection system and 1 truck per week for a STEP system. Actual removal frequency will depend on site storage developed during final design.

## 5.11 ACREAGE REQUIREMENTS

The acreage required by the various alternatives in conjunction with a gravity collection system ranges from 5,000 square feet (0.1 acres) for Sub-Class B biosolids with BFP dewatering to 5.7 acres for Sub-Class B with solar drying. Table 5.14 provides a breakdown of acreage requirements for each option. The Tri-W Project planned to produce Sub-class B biosolids using mechanical dewatering and thickening.

**Table 5.14 Maximum Acreage Requirements for Biosolids Treatment**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Assumed Treatment Processes On Site | Total Footprint Required with Gravity Collection (Acres)[1] | Total Footprint Required with STEP/STEG Collection (Acres)[2] |
|---|---|---|---|
| Sub-Class B Biosolids | Gravity Belt Thickening<br>Solar Drying | 5.7<br>(0.1 with BFP Dewatering) | 1.4<br>(0.1 with BFP Dewatering) |
| Digested Class B Biosolids | Gravity Belt Thickening<br>Aerobic Digestion<br>Solar Drying | 4.4<br>(0.2 with BFP Dewatering) | 1.1<br>(0.1 with BFP Dewatering) |
| Heat Dried Class B Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Indirect Heat Drying | 0.1 | 0.1 |
| Composted Class B Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Windrow Composting | 1.1 | 0.4 |
| Composted Class A Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Windrow Composting | 2.1 | 0.7 |
| Digested/ Composted Class A Biosolids | Gravity Belt Thickening<br>Aerobic Digestion<br>Belt Filter Press Dewatering<br>Windrow Composting | 2.2 | 0.7 |

Notes:
(1) Based on an average solids volume from primary and secondary treatment process of 4,000 pounds per day (dry weight).
(2) Based on an average solids volume from primary and secondary treatment process of 1,000 pounds per day (dry weight).

## 5.12 O&M COSTS FOR PARTIALLY MIXED FACULTATIVE PONDS

The O&M costs for a facultative pond are based on contracted mobile equipment to dredge, dewater, haul and dispose of the biosolids. Due to the size of a typical pond, the amount of biosolids accumulation can be significant. The contract O&M costs for a facultative pond in Imperial, CA, were $400,000 in 2003. This treatment facility was sized to handle a peak wastewater flow rate of 1.06 mgd. Escalating the costs to 2007 dollars and scaling up due to the difference in treatment flow rates, the contract O&M associated with dredging, dewatering, hauling and disposing of biosolids for a facultative pond in Los Osos would be approximately $600,000.

## 5.13 SUMMARY OF ALTERNATIVES

This section provides a summary of the alternatives available to Los Osos using the assumed unit processes discussed above. This includes a capital and O&M cost summary, potential considerations for selection of the preferred alternative, and the apparent least costly alternative.

### 5.13.1 Capital Cost Summary for Alternatives

Table 5.15 below summarizes the construction costs for solids treatment alternatives. The capital required to construct the six treatment alternatives ranges from $1.9 to $7.0 million assuming a gravity collection system and $1.0 to $5.0 million assuming a STEP/STEG collection system. The least capital cost alternative is Sub-Class B biosolids.

**Table 5.15 Capital Cost Summary for Solids Treatment Alternatives
Los Osos Wastewater Project Development
San Luis Obispo County**

| | Assumed Treatment Processes On Site | Estimated Capital Cost with Gravity Collection System ($M)(1) | Estimated Capital Cost with STEP/STEG Collection System ($M)(2) |
|---|---|---|---|
| Facultative Pond | Facultative Pond | 0 | 0 |
| Sub-Class B Biosolids(3) | Gravity Belt Thickening<br>Solar Drying | 1.9 - 2.4<br>(2.6 - 3.3 with BFP Dewatering) | 1.0 - 1.7<br>(1.4 - 2.4 with BFP Dewatering) |
| Digested Class B Biosolids | Gravity Belt Thickening<br>Aerobic Digestion<br>Solar Drying | 4.6 - 5.1<br>(5.3 - 6.0 with BFP Dewatering) | 2.4 - 3.5<br>(2.8 - 4.2 with BFP Dewatering) |
| Heat Dried Class B Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Indirect Heat Drying | 5.5 - 6.2 | 3.0 - 4.4 |
| Composted Class B Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Windrow Composting | 3.6 - 4.3 | 1.9 - 3.2 |
| Composted Class A Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Windrow Composting | 3.6 - 4.3 | 1.9 - 3.2 |
| Digested/ Composted Class A Biosolids | Gravity Belt Thickening<br>Aerobic Digestion<br>Belt Filter Press Dewatering<br>Windrow Composting | 6.3 - 7.0 | 3.3 - 5.0 |

Notes:
(1) Based on an average solids volume from primary and secondary treatment process of 4,000 pounds per day (dry weight).
(2) Based on an average solids volume from primary and secondary treatment process of 1,000 pounds per day (dry weight).
(3) The Tri-W Project included treatment and disposal of Sub-class B biosolids.

### 5.13.2 O&M Cost Summary for Alternatives

The estimated annual O&M costs for the seven treatment options are presented in Table 5.16. The annual O&M costs ranges from $40,000 to approximately $700,000 assuming a gravity collection system and $30,000 to $480,000 assuming a STEP/STEG collection system. The least cost O&M alternative is for a facultative pond.

**Table 5.16 O&M Cost Summary for Solids Treatment Alternatives**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Assumed Treatment Processes On Site | Estimated O&M Cost with Gravity Collection System ($M)(1) | Estimated O&M Cost with STEP/STEG Collection System ($M)(2) |
|---|---|---|---|
| Facultative Pond | Facultative Pond<br>Temporary Equipment | 0.04 – 0.05(3) | 0.03 – 0.04(3) |
| Sub-Class B Biosolids(4) | Gravity Belt Thickening<br>Solar Drying<br>Hauling | 0.43 – 0.47<br>(0.63 - 0.66 with BFP Dewatering) | 0.18 – 0.25<br>(0.28 – 0.38 with BFP Dewatering) |
| Digested Class B Biosolids | Gravity Belt Thickening<br>Aerobic Digestion<br>Solar Drying<br>Hauling | 0.43 – 0.47<br>(0.63 – 0.66 with BFP Dewatering) | 0.18 – 0.25<br>(0.28 – 0.38 with BFP Dewatering) |
| Heat Dried Class B Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Indirect Heat Drying<br>Hauling | 0.60 – 0.62 | 0.30 – 0.42 |
| Composted Class B Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Windrow Composting<br>Hauling | 0.68 – 0.71 | 0.35 – 0.48 |
| Composted Class A Biosolids | Gravity Belt Thickening<br>Belt Filter Press Dewatering<br>Windrow Composting<br>Hauling | 0.62 – 0.65 | 0.33 – 0.46 |
| Digested/ Composted Class A Biosolids | Gravity Belt Thickening<br>Aerobic Digestion<br>Belt Filter Press Dewatering<br>Windrow Composting<br>Hauling | 0.63 – 0.66 | 0.33 – 0.46 |

Notes:
(1) Based on an average solids volume from primary and secondary treatment process of 4,000 pounds per day (dry weight).
(2) Based on an average solids volume from primary and secondary treatment process of 1,000 pounds per day (dry weight).
(3) Based on $600,000 in 2007 dollars escalated at 5% per year until 2027 and saved for in equal annual installments.
(4) The Tri-W Project included treatment and disposal of Sub-class B biosolids.

## 5.14 POTENTIAL CONSIDERATIONS FOR ALTERNATIVE SELECTION

There are many issues that must be considered before a final alternative is selected. Table 5.17 summarizes some of those considerations for each treatment alternative.

**Table 5.17 Potential Considerations for Alternative Selection**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Treatment Alternative | Considerations for Alternative Selection |
|---|---|
| Sub-Class B Biosolids | Least expensive construction cost<br>Future flexibility for inclusion of digestion and/or composting<br>Most expensive hauling costs<br>Relatively low annual O&M costs<br>Most restrictive disposal option<br>Low acreage requirements<br>Odor problems likely if solar drying used |
| Digested Class B Biosolids | Relatively high construction cost<br>Future flexibility for inclusion of composting<br>Relatively low annual O&M costs<br>Moderate hauling costs<br>Ability to implement cogeneration (if cost effective) |
| Heat Dried Class B Biosolids | Least expensive hauling costs (except for local recycling)<br>Moderate to high construction cost<br>Moderate annual O&M costs<br>Low acreage requirements<br>Energy intensive process - economics mostly proportional to price of natural gas |
| Composted Class B Biosolids | Relatively high construction cost<br>High annual O&M costs<br>Less land required as compared to composting Class A<br>Composting requires large amounts of land<br>More restrictive disposal options as compared to Class A |
| Composted Class A Biosolids | Relatively high construction cost<br>High annual O&M costs<br>Least restrictive disposal option<br>Composting requires large amounts of land |
| Digested/ Composted Class A Biosolids | Most expensive alternative overall<br>High annual O&M costs<br>Least restrictive disposal option<br>Composting requires large amounts of land<br>Ability to implement cogeneration (if cost effective) |

## 5.15 ENVIRONMENTAL/PERMITTING CONSIDERATIONS

For most of the alternatives, the environmental effects and required mitigation for each of the treatment alternatives will be the same or similar. Impacts are similar to treatment plant development, both in the construction phase and during the life of the facility.

- Construction activities are similar to any building development. Short-term effects will include impacts to air quality, noise increases, traffic increases and visual disturbances.
- Depending upon the location, treatment plant siting could disrupt archaeological, agricultural or biological resources.
- Treatment facilities could have permanent visual impacts, including blocking of scenic vistas, new sources of nighttime lighting and buildings out of scale with the area.
- Odors are a concern of every treatment technology and, depending upon type and proximity to residences, will require some measure of treatment.
- Truck traffic. Hauling requirements will include one or more truck trips per day. Relative to other area traffic, this is minimal.
- Regulatory requirements for biosolids are in flux and will likely change in the future. This will require consideration of the type of biosolid treatment and disposal options.

## 5.16 APPARENT LOW COST ALTERNATIVES

The facultative pond treatment system has the lowest construction and annual O&M costs of any of the alternatives. However, the community should plan for significant activities and costs every 15 to 20 years to remove, dewater and dispose of solids that build up in the ponds.

The apparent least cost alternative for other treatment technologies is hauling of Sub-Class B biosolids. This alternative has the lowest initial capital cost and relatively low annual operation and maintenance costs. While it has the most restrictive hauling and disposal options, digestion and or composting can be added in the future if disposal options are eliminated or if the community desires to implement local composting/recycling.

# TREATMENT FACILITY SITING

## 6.1 OVERVIEW

The rough screening analysis eliminated properties within the Los Osos urban area because they offered no environmental or regulatory advantages over the Tri-W site. In addition, the Andre 1 and Turri Road properties were eliminated because of easement restrictions and agricultural issues, respectively. All of the remaining sites could support one or more treatment plant technologies that passed the rough screening analysis.

## 6.2 IDENTIFICATION OF PRIORITY SITES

The physical, environmental and regulatory characteristics revealed by the rough screening analysis (summarized on Table 6.3) were used to further categorize the suitability of the qualifying sites indicated in Table 6.1:

**Table 6.1 Priority Sites**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Classification | Distinguishing Characteristics | Properties |
|---|---|---|
| High priority | Properties with the fewest constraints and most advantageous location for construction of a treatment plant; | Cemetery, Giacomazzi, Branin |
| Lower Priority | Properties with more constraints and less advantageous location than First Tier properties; | Andre 2, Robbins 1, Robbins 2 |
| Lowest Priority | Properties with higher constraints that would render them last choice sites; | Gorby, Morosin/FEA |

The high priority sites will be the focus of the fine screening analysis that follows and are shown on Figure 6.1.

Tri-W remains a viable project alternative site in that a treatment facility was permitted at that location. While subsequent changes in the site's status relative to coastal permitting requirements may have occurred, those changes will be the subject of more detailed review during the CEQA process as they are beyond the level of detail contained in this report.

Tri-W is the eleven acre site on LOVR and Palisades that was the subject of the prior project's permitting efforts. It is centrally located in the collection area. It is home to endangered species, especially the Morro shoulderband dune snail, and its soil hosts coastal scrub habitat, both qualities qualifying the land as environmentally sensitive habitat.

A synopsis of issues for Tri-W has been added to Table 6.3.

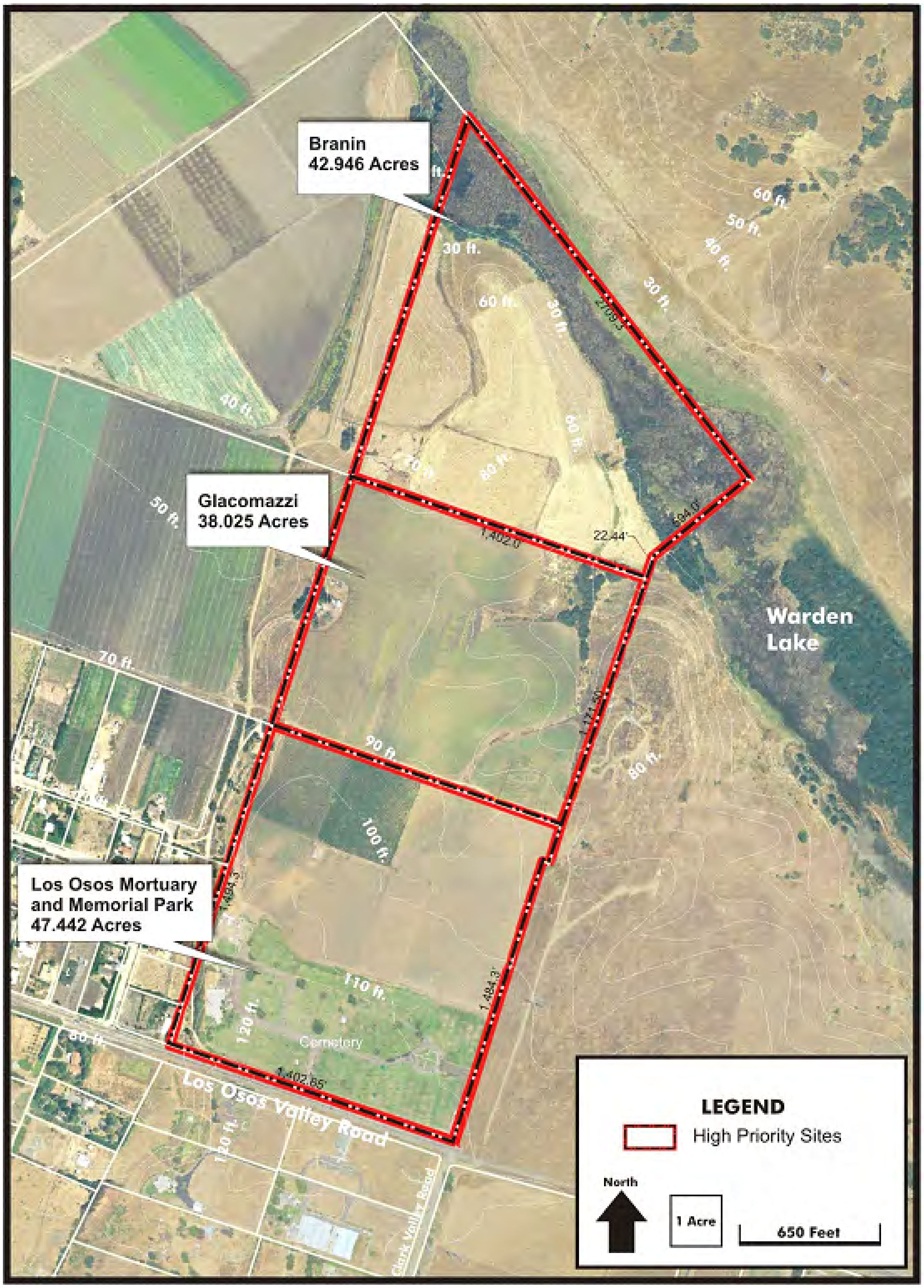


**Figure 6.1**
**HIGH PRIORITY SITES**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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## 6.3 OVERVIEW OF HIGH PRIORITY SITES

Table 6.3 provides a summary of the environmental and regulatory constraints affecting each of the high priority sites, which are described briefly below.

### 6.3.1 Cemetery Property

The Cemetery Property consists of a rectangular 47.4 parcel north of Los Osos Valley Road (LOVR); the Los Osos Mortuary and Memorial Park occupies the southerly portion of the site (about 19 acres). The site slopes gently downward to the north; the westerly boundary slopes downward to the west to a dirt road that provides access to surrounding farming operations. About 6.5 acres in the northwest corner is cultivated with row crops, with the remainder fallow. There are no large trees or other natural features.

Access is provided from LOVR by way of a level, unimproved road bordering on the east that intersects LOVR opposite Clark Valley Road. Figures 6.2 and 6.3 show photos of the Cemetery Property.

### 6.3.2 Giacomazzi

The Giacomazzi property is a rectangular 38.2-acre parcel north of LOVR and west of Clark Valley Road. The site slopes gently downward to the north and east toward an ephemeral drainage that extends along the easterly portion of the site to Warden Lake (offsite). The channel supports a small oak woodland along its northerly reaches adjacent to the Branin property. There is a collection of farm-related buildings along the western border with numerous tall trees surround the buildings. The level areas of the site have been cultivated with crops.

Access to the site is provided by way of an unimproved road bordering on the east that intersects LOVR opposite Clark Valley Road. Figure 6.4 is a photo of the Giacomazzi property.

### 6.3.3 Branin

The Branin property consists of an irregularly shaped 42.2 acre parcel north of LOVR and adjacent to Warden Lake which consists of native wetland and riparian vegetation. The site slopes to the north and contains two ephemeral drainages. Access to the site is provided by a dirt road that wraps around the Cemetery Property and provides access to surrounding farming operations. Figures 6.5 and 6.6 show photos of the Branin property. Figure 6.6 also includes the Giacomazzi property.


**Figure 6.2**
**THE CEMETERY PROPERTY**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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**Figure 6.3**
**VIEW SOUTH AND WEST**
**OVER CEMETERY PROPERTIES**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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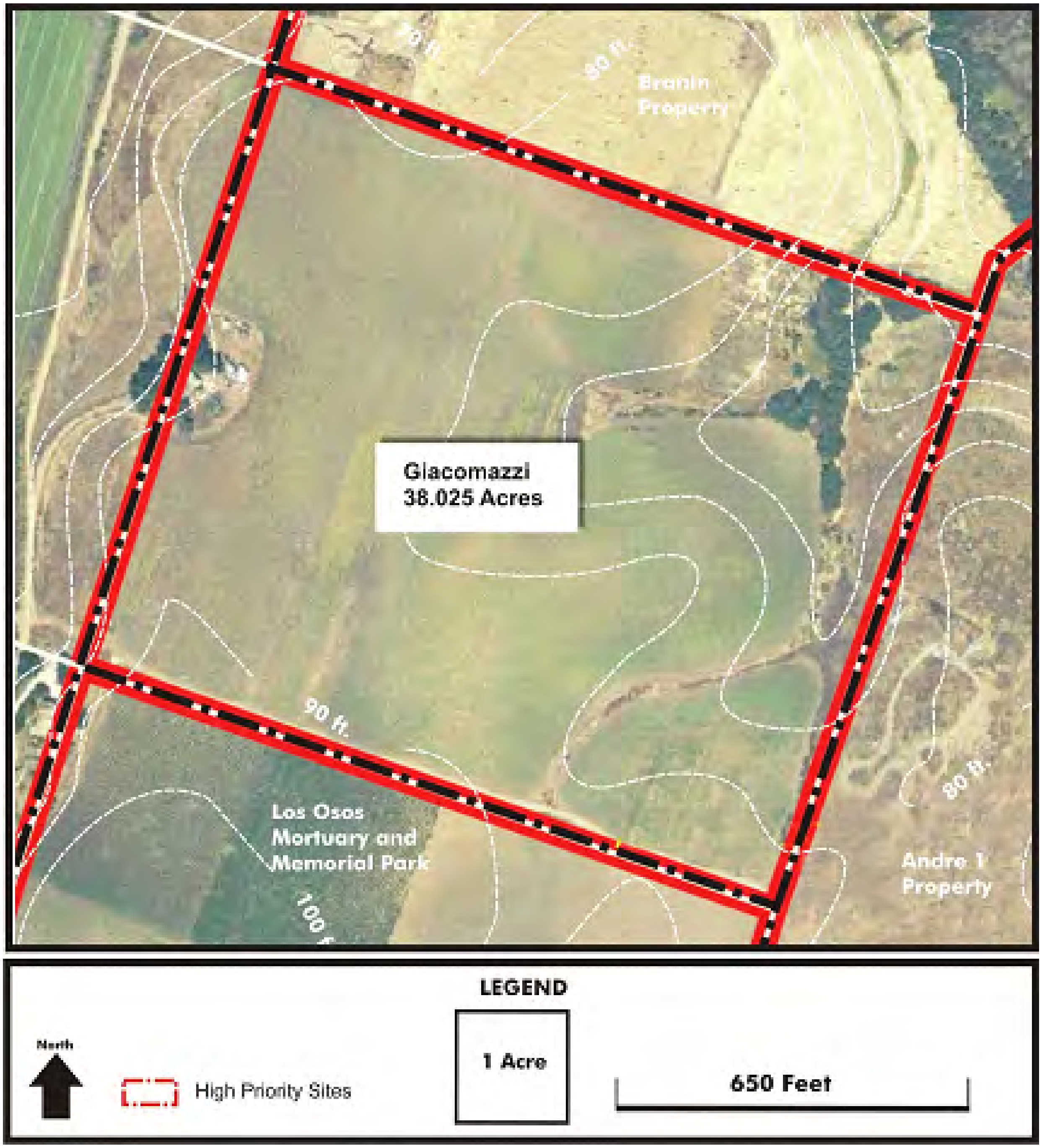


**Figure 6.4**
**THE GIACOMAZZI PROPERTY**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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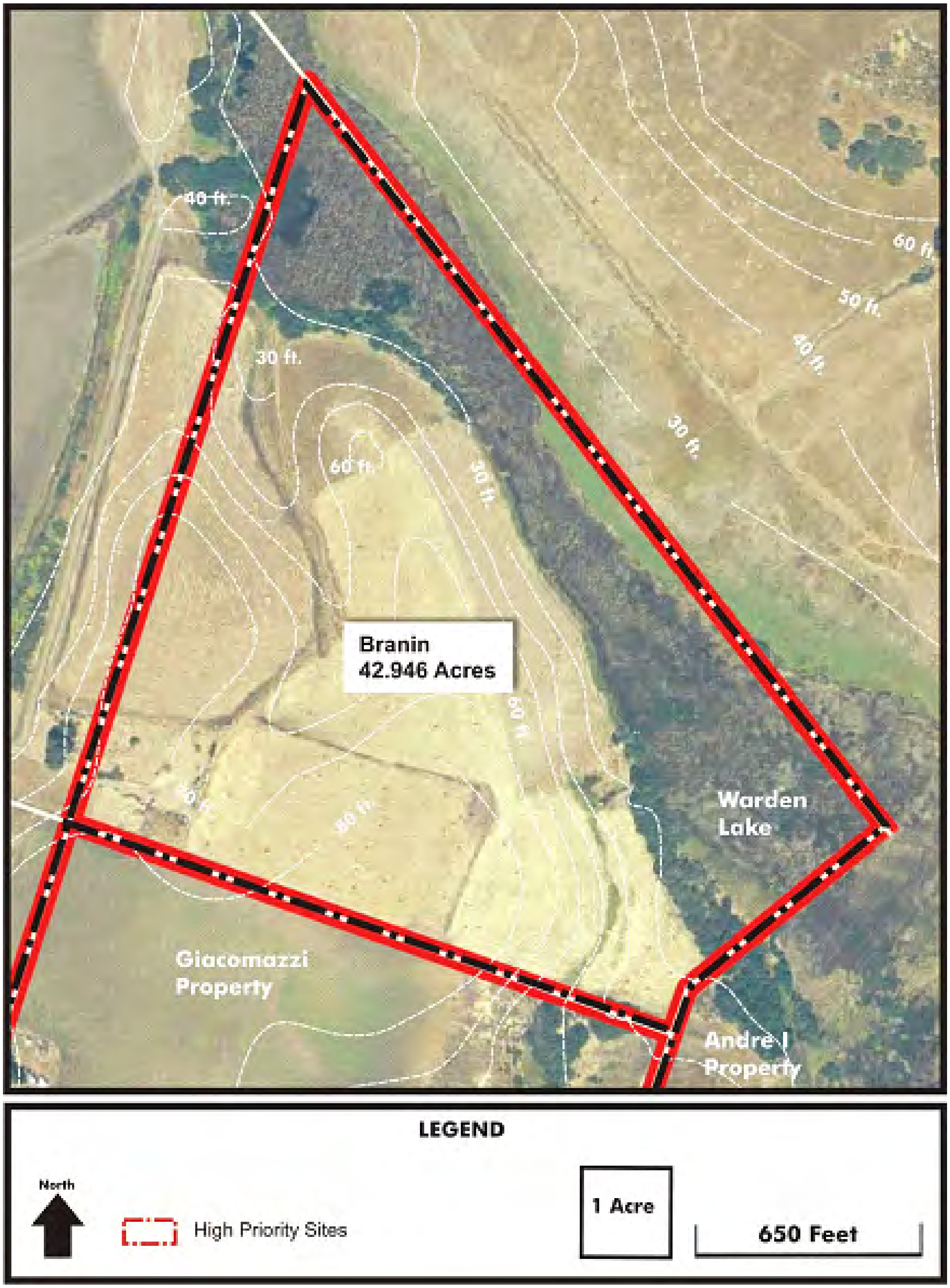


**Figure 6.5**
**THE BRANIN PROPERTY**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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**Figure 6.6**
**VIEW NORTHWEST OVER THE GIACOMAZZI AND BRANIN PROPERTIES**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

## 6.4 ENVIRONMENTAL AND REGULATORY CONSTRAINTS AFFECTING THE HIGH PRIORITY SITES

The characteristics identified by the rough screening analysis were mapped for each of the high priority properties. The purpose of this analysis was to create a composite constraints map (Figure 6.7), which identifies areas suitable for the placement of wastewater treatment facilities. In addition, the fine screening analysis provides a discussion of regulatory requirements, and in particular the relevant provisions of the County General Plan and California Coastal Act. And lastly, a preliminary title report was obtained for each high priority site to determine the extent of any private restrictions or other encumbrances.

### 6.4.1 Soils/Geotechnical

Soils on the high priority sites consist primarily of the Paso Robles Formation, which comprises the plateau and gently rolling hill area east of the alluvial deposits adjacent to Los Osos Creek. Alluvium is also located at the northerly boundary of the Branin property adjacent to the Los Osos Valley drainage and Warden Lake.

Sediments of the Paso Robles Formation are generally equivalent to stiff to hard cohesive soils and medium dense to very dense granular soils, which are less suitable for farming but are suitable for building sites. The soils adjacent to Los Osos Creek are Holocene alluvial deposits composed of cobble-pebble gravel, sand, silt and clay.

In June, 2004, a preliminary investigation of sub-surface geologic conditions was prepared by Fugro West, Inc for the Andre I site which is immediately east of, and adjacent to, the high priority sites. The Andre I site is considered representative of the high priority sites by virtue of close proximity and identical soils (Figure 6.8). Nonetheless, site-specific geologic investigations are being prepared to confirm these conclusions. The 2004 analysis revealed the following:

- As with all three high priority Sites, the Andre I site is underlain by materials of the Paso Robles Formation.
- Based on 7 Cone Penetrometer Tests (CPT) and site reconnaissance, the materials in the upper 3 to 4 feet appear to be relatively loose/soft and likely represent topsoil/colluvial materials disturbed during previous agricultural/discing activities. Below depths of 3 to 4 feet, the soil conditions interpreted from the CPT data consists of thinly to thickly interbedded clay, clayey silt, sandy silt, silty sand, and sand.
- Groundwater was not encountered within the CPTs at the locations or depths explored (20 to 60 feet). On the basis of those limited explorations, construction dewatering may not be required.

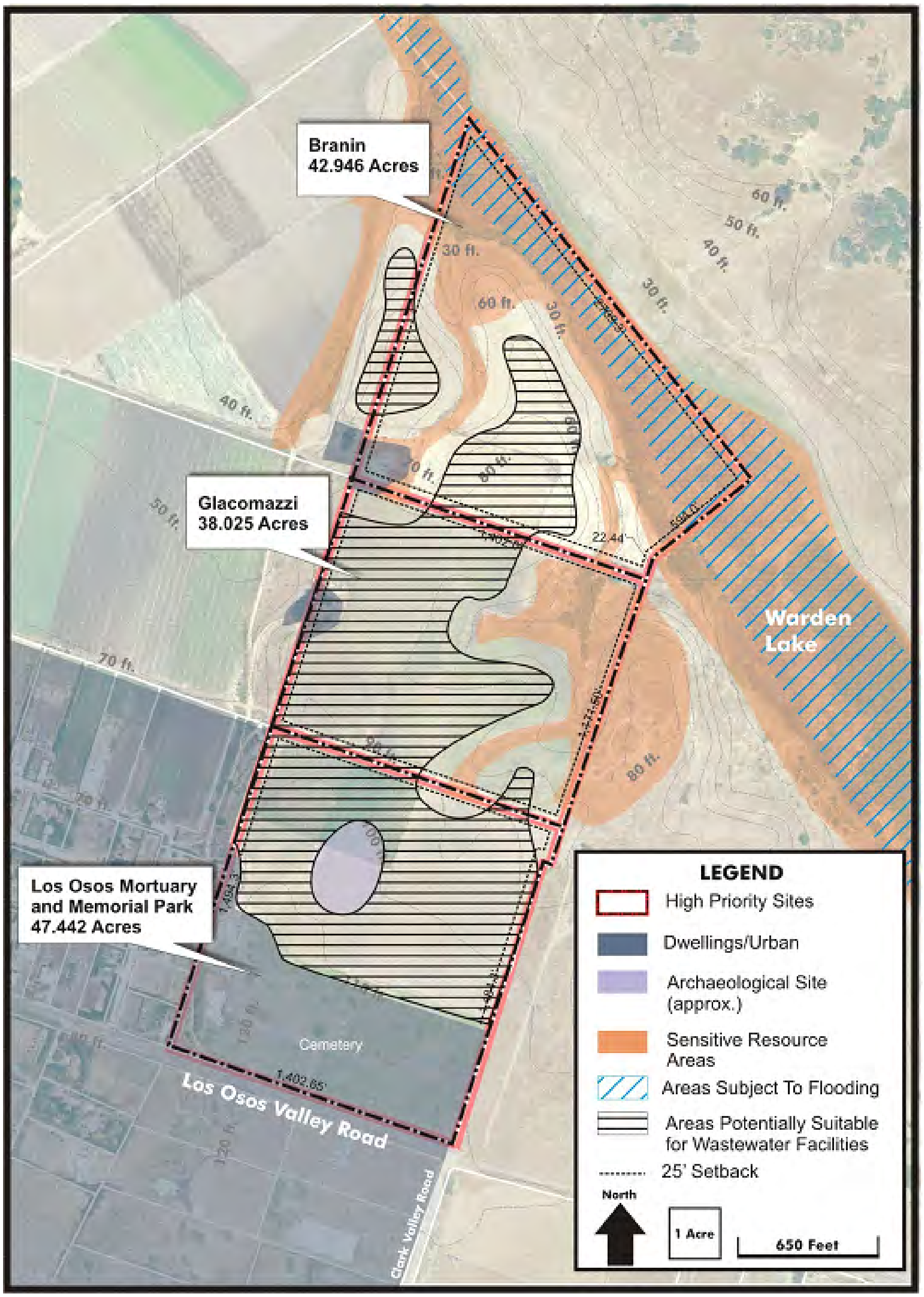


**Figure 6.7**
**COMPOSITE CONSTRAINTS MAP**
**FOR HIGH PRIORITY SITES**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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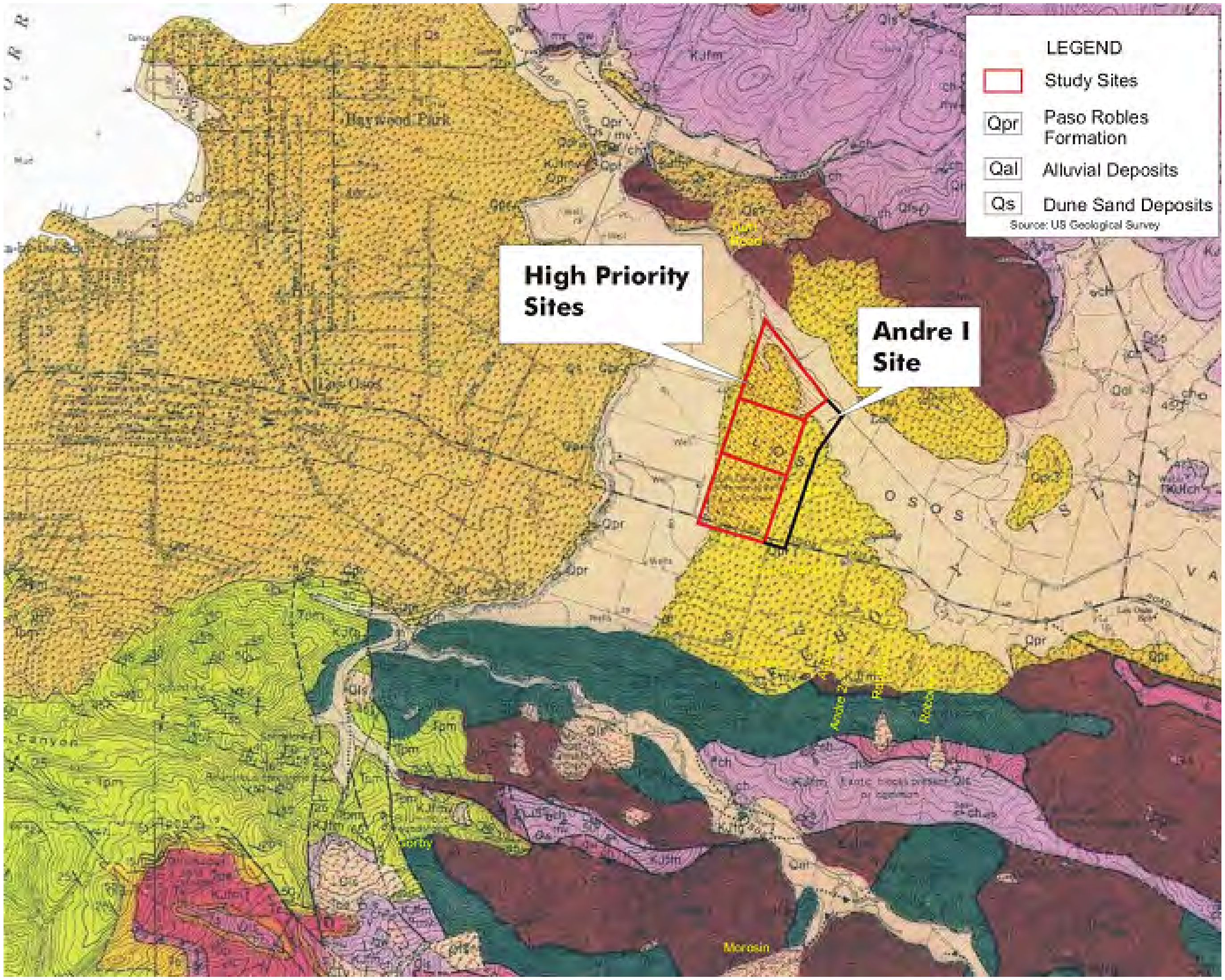


**Figure 6.8**
**SOILS AND GEOLOGIC CONDITIONS**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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- The Andre I site is located near the Los Osos fault, which is considered active and capable of generating at least a magnitude 6.8 earthquake. Although no indication of scarps or other fault-related features was observed on the Andre I site, the potential exists for fault rupture. Additional field exploration will be needed to assess whether faulting is present on the subject property and to recommend fault set-backs if present. Potential types of field exploration could consist of fault trenching, or a program of closely-spaced CPT soundings, and/or geophysical refraction surveys.
- The southern portion of the Andre I site underlain by the Paso Robles Formation has a low potential for liquefaction. Areas within the Warden Lake area were not evaluated as part of this preliminary study, but are likely to have a moderate to high liquefaction potential based on high groundwater and recent alluvial sediments.
- Areas underlain by the Paso Robles Formation should not be impacted by seismically induced settlement. Areas within the Warden Lake area may be subject to seismically induced settlement or hydroconsolidation.
- Slope instabilities associated with bank and/or headward erosion may occur along the banks of the drainages.

Overall the Andre I site was found to be suitable from a geotechnical standpoint to construct wastewater facilities. To the extent that site-specific geotechnical investigations of the high priority sites reveal conditions similar to those on the Andre I site, the high priority sites may also be suitable from a geotechnical standpoint.

### 6.4.2 Grading and Erosion

As discussed above, each of the high priority sites is composed largely of soils of the Paso Robles formation, which are suitable for irrigated agriculture but are subject to erosion. This is evident on the Giacomazzi and Branin properties where seasonal drainage channels have been eroded over the years.

Construction activities, such as the grading of building sites and the excavation of disposal holding basins, will have the potential to result in erosion and/or to accelerate the natural erosion associated with existing drainage channels. These issues can be addressed by adhering to Best Management Practices for grading operations.

### 6.4.3 Regulatory Constraints

#### 6.4.3.1 County General Plan and Local Coastal Program

All of the high priority sites are located within the Coastal zone and are therefore subject to the provisions of San Luis Obispo County's Local Coastal Plan (LCP). The LCP functions as the General Plan for the portions of the unincorporated County within the Coastal Zone and consists of the Land Use Element (LUE), Coastal Zone Land Use Ordinance (CZLUO), a Costal Policies Document and the official planning maps. The Giacomazzi and Branin sites are designated *Agriculture* by the LUE, the Cemetery Property is designated *Public*

*Facilities*. Accordingly, development of a treatment facility will be governed by the adopted Local Coastal Program (LCP).

The County LCP establishes the allowed land uses in the coastal zone. Pipelines are allowed in all land use designations, subject to the restrictions contained in Section 23.08.286 of the CZLUO. A wastewater treatment facility is considered a *Public Utilities Center,* which is allowed, subject to Development Plan approval, in the Agriculture land use category subject to special use and development standards contained in Section 23.08.288 of the Coastal Zone CZLUO.

**Pipelines**. Section 23.08.286 of the CZLUO describes special restrictions for pipeline development. A minor use permit is required when the area of site disturbance would exceed 40,000 square feet. Since installation of the collection system would likely disturb more than 40,000 square feet, a minor use permit would be required. However, the collection system and treatment facility will be considered one project for purposes of permit review and both will be included in one Development Plan. Because they are components of a single project, Section 23.08.286 of the CZLUO requires that proponents of pipeline projects conduct a geologic investigation, cultural resources survey, and a biological survey (when in a Sensitive Resource Area). These requirements would be addressed by the environmental document prepared for the project.

**Treatment Plant**. Section 23.08.288 of the CZLUO describes special requirements pertaining to the development of public utility facilities. In addition to outlining the permit application requirements, these special use and development standards require the submission of an "environmental quality assurance program" covering all aspects of construction and operation. The program provides a schedule and procedures for compliance with all conditions of Development Plan approval. Item d. of the special use standards prohibits public facilities from being located on land containing environmentally sensitive habitat unless a finding is made by the applicable approval body that there is no other feasible location. A feasibility study must be included to support such a finding.

Chapter 7 of the Coastal Zone Framework for Planning document (part of the Coastal Zone Land Use Element) addresses site selection and location criteria for public facilities, including wastewater treatment plants. The siting information in chapter 7 is presented as *recommended* distances from *suggested* locations, in recognition of the fact that other policies in the Coastal Zone Land Use Element can make siting of a public facility difficult. The location criteria are also presented as a means to protect potential public facilities sites from premature development with other uses. Therefore, while Table P of Chapter 7 indicates that "sewage treatment facilities" should be located within 1/2 mile of locations specified on the official land use maps, the maps for the Los Osos Area (both urban and rural) contain no suggested locations for sewage treatment facilities other than the permitted site at Tri-W. Given that the public facilities designation was applied to the Tri-W site only after the site was selected for a wastewater treatment facility, the location/siting criteria contained in Coastal Zone Framework for Planning should not be considered an impediment to the development of a treatment plant on another appropriate site.

In addition to location criteria, other policies and ordinances contained in the LCP call for projects to be designed and sited in a manner which avoids or minimizes impacts to sensitive habitat areas. Policy 1 for Environmentally Sensitive Habitats requires that "New development within or adjacent to locations of environmentally sensitive habitats (within 100 feet unless sites further removed would significantly disrupt the habitat) shall not significantly disrupt the resource..." Accordingly, Figure 6.7 applies this minimum 100-foot setback to all areas with the potential to be considered Environmentally Sensitive Habitat Areas.

Any coastal development permit issued by the County for a new wastewater treatment facility located in the Coastal Zone is appealable to the state Coastal Commission. Section 30412 of the State Coastal Act (CA Public Resources Code section 30000 et seq) limits the Coastal Commission's consideration of a permit for a “treatment works” to the following specific issues:

- Siting and design: has the project been sited and designed in a manner that complies with LCP standards, such as those requiring the protection of environmentally sensitive habitats and visual resources, and with Coastal Act access and recreation policies?
- Service area and phasing: is the proposed service area and phasing program consistent with LCP directives regarding the location and timing of new development?
- Capacity: has the project been sized consistent with the amount of development planned for by the LCP?

These policies are initially applied by the agency issuing the Coastal Development Permit, which for this project is the County of San Luis Obispo.

#### 6.4.3.2 Special Status Species

As discussed in the Rough Screening analysis, the Los Osos area provides habitat for a number of special status species, as well as other sensitive biological resources that include riparian corridors (Los Osos Creek) and wetlands. Special-status species are plants and animals that are either listed as ‘endangered’ or ‘threatened’ under the Federal or California Endangered Species Acts, listed as ‘rare’ under the California Native Plant Protection Act, or considered to be rare (but not formally listed) by resource agencies, professional organizations, and the scientific community.

The portions of the high priority sites where native vegetation remain (largely within the natural drainages) have been excluded from consideration for the placement of wastewater facilities (Figure 6.7). Moreover, the cultivated areas where facilities would likely be placed have been periodically cultivated leaving little or no habitat value for special status plants or animals. Thus, to the extent wastewater facilities are confined to previously cultivated areas, they would have a low probability of adversely affecting special status plant or animal species.

### 6.4.4 Archaeological Resources

As discussed in the Rough Screening analysis, over 60 archaeological sites have been identified among the stabilized dunes of Los Osos and extending to the east along both sides of Los Osos Creek and beyond. Thus, the potential to un-earth previously undiscovered archaeological resources should be considered high, especially for sites near Los Osos Creek and in the area of the high priority sites.

Previous archaeological investigations have revealed at least one archaeological site (Site 25) that affects the northeasterly portion of the Cemetery Property. This area should be investigated further to determine the extent of the resources.

### 6.4.5 Flooding/Slope

Each of the high priority sites possesses level, or nearly level, areas where a treatment plant could be located. As shown on Figures 6.4 and 6.5, the Giacomazzi and Branin properties each possess ephemeral natural drainage courses, which exhibit cut banks, and steep grades that may prove problematic for construction of treatment facilities. The northerly portion of the Branin site is crossed by Warden Lake and the floodplain of Los Osos Creek.

### 6.4.6 Visual Sensitivity

The high priority sites lie along an important visual corridor (LOVR) at the entrance to the community. The visual sensitivity of these sites diminishes with distance from LOVR. This is due in part to the intervening physical features such as the cemetery and associated landscaping. More importantly, the topography north of LOVR slopes downward toward Los Osos Creek and affords natural screening when viewed from the roadway. The high priority sites can be ranked from highest to lowest visual sensitivity as follows:

1. Cemetery Property
2. Giacommazi
3. Branin

The visual sensitivity of each high priority site can be effectively mitigated by a combination of building design and location, grading to take advantage of the natural screening afforded by the topography, and the placement of landscaping, fencing or other features.

### 6.4.7 Agricultural Resources

As discussed in the Rough Screening analysis, the high priority sites consist of Class III (non-prime) soils. Portions of each site are not being farmed, in part because of topography (Branin and Giacomazzi) and existing uses (the cemetery). Nonetheless, each has ongoing agricultural operations and the conversion of all or a portion of these properties for wastewater facilities would result in the permanent loss of these resources. However, as revealed by the Rough Screening analysis, the area of the high priority sites is the least productive soils with the closest proximity to the community.

The Branin property is within an Agricultural Preserve, which is the prelude to inclusion in a Williamson Act Contract. However, since it is not formally contracted, it is not subject to the restrictions of the Williamson Act, especially as they relate to implications for conversion to another land use.

### 6.4.8 Biological Resources

Potentially important biological resources associated with the high priority sites are confined to uncultivated areas consisting of native and non-native vegetation. These areas include the seasonal drainages on the Branin and Giacomoazzi properties, and the wetlands that are associated with Los Osos Creek and Warden Lake. These areas are considered environmentally sensitive and should be avoided consistent with the regulatory requirements discussed above under item 6.4.3.

There are also large stands of trees surrounding the existing dwellings on the Giacomazzi and Branin properties that could support nesting or roosting raptors. The agricultural fields may provide suitable habitat for foraging raptors.

### 6.4.9 Creek Crossing

Locating the treatment and disposal facilities east of the Los Osos urban area will necessitate crossing Los Osos Creek with a collection pipeline and possibly a treated water pipeline. The two potential adverse consequences of this approach are: 1) the potential for a failure of the pipelines where they cross Los Osos Creek, and 2) construction-related impacts to the Creek.

There are at least three solutions for crossing the Creek: tunneling under, trenching through, and hanging the pipes on the existing bridge.

<u>Tunneling</u>

One of the first wastewater systems proposed for Los Osos included crossing Los Osos Creek on the easterly extension of the Santa Ysabel Street alignment. The approach chosen for crossing the creek was to tunnel under at the location of an abandoned roadway bridge. Tunneling was considered superior to trenching with respect to minimizing disturbance of the creek at that specific location.

Although trenchless technology offers a feasible alternative for the creek crossing, this approach still requires compliance with regulatory and permitting requirements which are considerable. Installation of pipelines under the Creek would require:

- A federal Clean Water Act section 404 permit from the US Army Corps of Engineers

- A federal Clean Water Act section 401 water quality certification from the Regional Water Quality Control Board
- A federal consistency certification from the CA Coastal Commission
- A Section 7 consultation with the US Fish and Wildlife Service and with the National Marine Fisheries Service
- Compliance with relevant provisions of the California Coastal Act relating to the protection of Environmentally Sensitive Habitat Areas.
- A CA Fish and Game Code section 1600 permit from the CA Department of Fish and Game

Trenching

Trenching may be feasible in some locations during the dry season when there is no flowing water in the stream. Trenching requires the suite of regulatory permits and consultations required for tunneling; in addition, trenching would require full restoration of the disturbed streambed and banks. Although permitting a trenched crossing would trigger greater scrutiny from regulatory agencies, the approach may be feasible depending on the particular resource constraints at the specific site.

Bridge-Mounted Crossing

A third approach would be to hang the pipelines under the existing bridge at Los Osos Valley Road. This approach minimizes potential impacts to the Creek from construction since the pipes would be suspended above the Creek. However, the regulatory requirements would be similar to tunneling depending on the amount of disturbance of the creek bank on either side of the bridge where the pipes re-enter the ground.

If the treatment plant is located east of the Los Osos urban area, all of the untreated wastewater and at least a portion of the treated wastewater will pass over or under Los Osos Creek. As discussed elsewhere, the Los Osos fault is present in the vicinity, and a seismic event associated with the fault could result in a failure of one or both force mains near the Creek and a release of untreated sewage and/or disposal water into the Creek and Estuary. Provisions would be necessary to minimize the environmental effects of a pipeline failure.

### 6.4.10 Title Restrictions

A preliminary title report was obtained for each high priority site to determine the extent of any private restrictions, easements or other encumbrances that may affect the placement of wastewater facilities. Although each property is subject to minor easements, such as electrical and water utilities, none should pose a meaningful constraint to the placement of facilities.

### 6.4.11 Useable Acreage/Topography

Mapping the environmental and regulatory constraints affecting the high priority sites reveals areas on each site that are potentially suitable for the placement of treatment and/or disposal facilities (Figure 6.7). It should be noted that the mapping of constraints takes a conservative approach in that certain features, such as the seasonal drainages on the Branin and Giacomazzi properties, have been mapped as constraints when in fact certain portions with marginal drainage or resource value may be suitable for the placement of facilities. Accordingly, the actual acreage that may be suitable for facilities will likely be greater than the areas shown on the map. Table 6.2 provides an estimate of the acreage of each site that may be suitable for the placement of facilities, based on the conservative mapping of constraints described above.

**Table 6.2 Summary of Acreage Potentially Suitable for Facilities**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| High Priority Site | Total Acreage | Estimated Acreage Suitable for Facilities |
|---|---|---|
| Cemetery Property | 47.442 | 19 - 21 acres |
| Giacomazzi | 38.02 | 16 – 18 acres |
| Branin | 42.946 | 8 – 10 acres |
| Total All Sites | 128.4 | 43 – 49 acres |

### 6.4.12 Traffic

Construction and operation of any treatment works will involve trips that have some effect on area traffic. The important comparison is between an in-town site (Tri-W) and any of the sites identified to the east of Los Osos. On average, trips coming to and from Tri-W will encounter more traffic, but the rate of speed will be far less. Vehicles begin to reach highway speeds as they approach the cemetery, the area of the top tier alternative sites. During construction this can be managed with traffic control signage and personnel in any location. During operations, the traffic to and from the plant is negligible. Sludge hauling amounts to one or two trips per day. However, speed and site distance considerations on Los Osos Valley Road serving sites near the cemetery will need to be considered and may require intersection improvements.

## 6.5 REAL PROPERTY ESTIMATES

Land in the Coastal Zone varies considerably depending upon location and land use designation. The allowable number of homes and ability to raise high quality crops are important factors.

According to estimates provided by the County right-of-way agent and appraiser, larger parcels east of Los Osos Creek could range in cost from $30,000 to $50,000 per acre. This may not capture the full range, with the volatility of the market and the idiosyncrasy of parcels.

A 40-acre parcel could cost between $1,000,000 and $3,000,000.

The 600-acre Tonini property, which would be considered for spray irrigation, is on the market for approximately $7,000,000, or roughly $12,000 per acre. Note that large portions of the Tonini property are steeply sloped and unusable for wastewater facilities, making the actual cost per acrea of usable land greater than $12,000 per acre.

## 6.6 SUMMARY AND FINE SCREENING OF SITES

Table 6.3 provides a summary of potential treatment facility sites. The preceding fine screening analysis supports the following findings and recommendations:

- The high priority sites together possess about 43 to 49 acres of land suitable for the placement of wastewater facilities. The actual acreage will likely be higher because of the conservative treatment of constraints. Portions of multiple sites may be assembled if necessary, depending upon the treatment process.
- Site-specific geotechnical investigations will be needed to assess the presence of the Los Osos fault and the geotechnical suitability of each site. However, geotechnical investigation of an adjoining property found no geotechnical constraints.
- The regulatory requirements for crossing Los Osos Creek with a pipeline are extensive. Crossing the Creek creates the potential for a spill arising from a failure of the collection and/or disposal pipeline.
- The use of all or a portion of the high priority sites for wastewater facilities will result in the permanent loss of all or a portion of the agriculture productivity of these properties.
- Should the Cemetery Site be considered for the placement of wastewater facilities, the previously identified archaeological site should be further investigated to determine the extent of the resources.
- The use of the northerly portion of the Cemetery Site would be constrained by any expansion of the Los Osos Mortuary and Memorial Park.

**Table 6.3 Summary Characteristics of Priority Sites**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Property | APN | Acreage | Description/ Topography | Flood Hazard | Access to Infrastructure | Agricultural Land | Biological Resources | Archaeological Resources | Hydro-Geology, Soils and Geologic Hazards | Visual Resources | Proximity of Sensitive Receptors | Proximity to Collection Area and Disposal Sites | Other Site-Specific factors | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **High Priority Sites** | | | | | | | | | | | | | | |
| Giacomazzi | 067-011-022 | 38.0 | Rectangular parcel that slopes gently downward to the north and east toward an ephemeral drainage that extends along the easterly portion of the site to Warden Lake (offsite); collection of farm-related buildings along the western border; level areas have been cultivated with row crops (irrigation?); numerous tall trees around the buildings and in the drainage channel; useable portion of site is 16-18 acres. | None; however, drainage channel conveys seasonal runoff | Close to LOVR, with level, unimproved road bordering on the east that intersects LOVR opposite Clark Valley Road; no public water supply; electricity at LOVR? | Class III; no LCA contract | Ephemeral drainage and surrounding sloping (uncultivated) areas support native and non-native grasses and; numerous tall trees in channel and adjacent to buildings; drainage channel may support riparian species; | Previously identified archaeological site (site 25) may extend onto this site | Soils are suitable for building; no landslides; potential for Los Osos fault; | Site is about one third mile from LOVR and partially visible to passing motorists; gently sloping terrain may help reduce apparent height/prominence of buildings; | Cemetery is about one quarter mile to the south; residences on five-acre lots adjacent to the south and west; surrounding properties are ag operations. | Useable portion of site is within one eighth mile of LOVR; site appears large enough to support some level of on-site disposal; | No known easements or other restrictions; | |
| Cemetery Property | 074-222-014 | 47.4 | Rectangular parcel that slopes gently downward to the north; westerly boundary slopes downward to the west to a dirt road that provides access to surrounding farming operations; southerly third of the site is used for a cemetery, about 7 acres in the northwest corner is cultivated with row crops, with the remainder fallow; no trees, or other natural features; useable portion of site is 19-21 acres. | None | Close to LOVR, with level, unimproved road bordering on the east that intersects LOVR opposite Clark Valley Road; no public water supply; electricity at LOVR? | Class III; northwest portion appears irrigated; no LCA contract | No apparent habitat value; | Previously identified archaeological site (site 25) | Soils are suitable for building; no landslides; potential for Los Osos fault; | Site is close to LOVR and visible to passing motorists; gently sloping terrain may help reduce apparent height/prominence of buildings; | Cemetery immediately adjacent to the south; residences on five-acre lots adjacent to the west; surrounding properties are ag operations. | Useable portion of site is within one eighth mile of LOVR; site appears large enough to support some level of on-site disposal; | No known easements or other restrictions; | Expansion plans for cemetery unknown; |
| Branin | 067-011-020 | 42.9 | Irregularly shaped lot north of LOVR and adjacent to Warden Lake which consists of native wetland and riparian vegetation; site slopes to the north toward Warden lake and contains two ephemeral drainages; useable portion of the site appears to be periodically cultivated and consists of 8-10 acres. | Northerly third of site lies within the floodplain of Los Osos Creek/Warden lake | Close to LOVR, but no apparent improved access; no public water supply; electricity at LOVR? | Class III on the southerly 25 acres; native soils and wetland/riparian vegetation on the remainder; no LCA contract on site; | Northerly third of the site is composed of native vegetation which may support special status plant and animals species; cultivated area appears to have no habitat value; ephemeral drainages appear to have limited habitat; | Previously identified archaeological site (site 13) extends onto this site; | Soils on level portion of site are suitable for building; may be potential for landslides on slopes leading down to warden lake; potential for Los Osos fault; | Site is about two-thirds mile from LOVR and marginally visible to passing motorists; sloping terrain may help reduce apparent height/prominence of buildings; | Cemetery is about two-thirds mile to the south; residences on five-acre lots located about two-thirds mile to the south and west; surrounding properties are ag operations. | Useable portion of site is about two-thirds mile from LOVR, but appears to have no improved access; site appears large enough to support some level of on-site disposal; | No known easements or other restrictions; | |

**Table 6.3 Summary Characteristics of Priority Sites**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Property | APN | Acreage | Description/ Topography | Flood Hazard | Access to Infrastructure | Agricultural Land | Biological Resources | Archaeological Resources | Hydro-Geology, Soils and Geologic Hazards | Visual Resources | Proximity of Sensitive Receptors | Proximity to Collection Area and Disposal Sites | Other Site-Specific factors | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lower Priority Sites** | | | | | | | | | | | | | | |
| Robbins 1 | 067-031-037 | 41.1 | Mostly rectangular-shaped lot abutting the north side of LOVR east of Clark Valley Road; site contains at least one dwelling and slopes to the north toward Warden Lake; large mature trees surround the farm buildings; site may be used for grazing; buildable portion of the site is about 30 acres. | Northerly portion of site lies within the floodplain of Warden Lake | Site abuts LOVR; no public water supply; electricity? | Class III on the southerly 30 acres; native soils and wetland/riparian vegetation on the remainder; no LCA contract on site; | Northerly portion of the site is composed of native vegetation/wetlands which may support special status plant and animals species; fallow area appears to have limited habitat value; | No known archaeological sites | Soils on level portion of site are suitable for building; no landslides; potential for Los Osos fault; | Site is adjacent to LOVR, and would be fairly visible to passing motorists; gently sloping terrain may help reduce apparent height/prominence of buildings | . Cemetery and residences on five-acre lots are about one mile to the west; one building (residence) on property to the east; church is located along south side of LOVR about one-half mile to the west; surrounding properties are ag operations. | Site abuts LOVR and appears large enough to support some level of on-site disposal; | No known easements or other restrictions; | |
| Robbins 2 | 067-031-38 | 43.5 | Mostly rectangular-shaped lot abutting the north side of LOVR east of Clark Valley Road; site slopes to the north toward Warden Lake; site may be used for grazing; buildable portion of the site is about 35 acres. | Northerly portion of site lies within the floodplain of Warden Lake | Site abuts LOVR; no public water supply; electricity? | Class III on the southerly 35 acres; native soils and wetland/riparian vegetation on the remainder; no LCA contract on site; | Northerly portion of the site is composed of native vegetation/wetlands which may support special status plant and animals species; fallow area appears to have limited habitat value; | No known archaeological sites | Soils on level portion of site are suitable for building; no landslides; potential for Los Osos fault; | Site is adjacent to LOVR, and would be fairly visible to passing motorists; gently sloping terrain may help reduce apparent height/prominence of buildings. | Cemetery and residences on five-acre lots are about one mile to the west; at least two buildings (residences) on property to the east; church is located along south side of LOVR about one-half mile to the west; surrounding properties are ag operations. | Site abuts LOVR and appears large enough to support some level of on-site disposal; | No known easements or other restrictions; | |
| Andre 2 | 067-031-011 | 9.87 | Narrow, triangular shaped parcel bordering LOVR; site slopes gently downward to the north; one small building; access provided from adjacent parcel in common ownership; one group of large trees that follows an ephemeral drainage that crosses the northerly portion of the site; useable area of site is about 9 acres, but narrow triangular shape limits development flexibility. | None; however, drainage channel conveys seasonal runoff | Borders LOVR, with level, unimproved road providing access from adjacent property to the west that intersects LOVR east of Clark Valley Road; no public water supply; electricity at LOVR? | Class III; no LCA contract | Site supports native and non-native grasses; ephemeral drainage contains numerous tall trees in channel; | No known archaeological sites | Soils are suitable for building; no landslides; potential for Los Osos fault; | Site is adjacent to LOVR where the largest developable area is also located; would be highly visible to passing motorists; gently sloping terrain may help reduce apparent height/prominence of buildings, but site boundaries narrow to the north; | Cemetery is about one quarter mile to the west; residences on five-acre lots are about one-half mile to the west and to the south; cluster ag-related buildings (including two residences) on properties to the east; church is located along LOVR about one-quarter mile to the west; surrounding properties are ag operations. | Most useable portion of site is adjacent to LOVR; site appears too small and irregularly shaped to support on-site disposal; | No known easements or other restrictions; | |

## Table 6.3 Summary Characteristics of Priority Sites
## Los Osos Wastewater Project Development
## San Luis Obispo County

| Property | APN | Acreage | Description/ Topography | Flood Hazard | Access to Infrastructure | Agricultural Land | Biological Resources | Archaeological Resources | Hydro-Geology, Soils and Geologic Hazards | Visual Resources | Proximity of Sensitive Receptors | Proximity to Collection Area and Disposal Sites | Other Site-Specific factors | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Lowest Priority Sites** | | | | | | | | | | | | | | |
| Morosin/FEA | 067-171-084 | 81.2 | Irregularly shaped parcel located south of LVOR on the east side of Clark Valley Road at the base of the Irish Hills; southerly half of the site slopes upward into the foothills and is composed of native vegetation; northerly half of site is relatively flat and has been cultivated with row crops; site contains a church with parking and access road on a small knoll at the northerly border of the site; cluster of ag-related buildings located at the base of the foothills; water tank is located about 100 meters upslope from the ag buildings; useable area of site is about 35 acres. | None | Close to LOVR, with level, borders Clark Valley Road, which is a paved, two-lane county road; no public water supply; electricity? | Class III on the northerly 35 acres; native soils and vegetation on the remainder; no LCA contract on site; property adjacent to the west is governed by an LCA contract. | Southerly (and un-buildable) portion of the site is composed of native vegetation which may support special status plant and animals species; cultivated area appears to have no habitat value; no creeks or ephemeral drainages | No known archaeological sites | Soils on level portion of site are suitable for building; no landslides; potential for Los Osos fault; | Site borders Clark Valley Road which provides access to a small number of ranches and farms in the Clark Valley to the south; site is about one-half mile from LOVR and would be at least partially visible to passing motorists; intervening properties are mostly level and cultivated periodically with row crops; | Church located on site; various farming/equestrian operations on surrounding properties of varying size; residences on five-acre site located about one mile to the west; | Useable portion of site is within one half mile of LOVR; site appears large enough to support some level of on-site disposal; | PG&E easement affects westerly 420 feet of site where buildings are prohibited; property immediately adjacent to the north is subject to a conservation easement; | |
| Gorby | 074-225-009 | 51.7 | Irregularly-shaped lot located south of LOVR adjacent to the east side of Los Osos Creek; southerly half of the site slopes upward into the foothills of the Irish Hills and contains native vegetation; the north-westerly portion is level and contains a dwelling and equestrian facilities that include horse paddocks and riding areas. Several ornamental trees occupy the northwesterly portion of the site; level buildable portion of the site is triangular and consists of about 20 – 25 acres. | Site borders Los Osos Creek which is subject to periodic flooding in major storm events; buildable area appears to be outside the 100 year floodplain; | Two lane dirt road provides access to LOVR opposite Lariat Drive; no public water supply; electricity? | Class I on level area; no LCA contract | Southerly (and un-buildable) portion of the site is composed of native vegetation which may support special status plant and animals species; Los Osos Creek supports mature native riparian vegetation; equestrian area appears to have no habitat value; | Numerous archeological sites have been identified along Los Osos Creek which have been mapped to this property. | Soils on level portion of site are suitable for building; no landslides; potential for Los Osos fault; | Site is about two-thirds mile from LOVR and marginally visible to passing motorists; shape of lot and intervening vegetation may help reduce prominence of buildings; | Dwellings on five-plus acre lots located immediately to the west of Los Osos Creek; Mobile home park located within one-quarter mile to the northwest; to the north are large-lot subdivisions with ag-related operations; to the east is a church; | Useable portion of site is about two-thirds mile from LOVR with access provided by unimproved road which also serves the intervening agricultural operations; site may be large enough to support some level of on-site disposal, including creek discharge; | No known easements or other restrictions; | |
| **Tri-W** | | | | | | | | | | | | | | |
| Tri-W | 074-229-017 | 11 + | This site was rough graded for the treatment plant and drainage basin. It generally sloped gently south to north. | The parcel is not in any designated flood hazard area. However, a large volume of water comes down the hill from Redfield Heights, crosses LOVR and onto this property. This is why the large drainage basin was constructed for the County. | The site is served by water, gas and electricity. The plant would require additional electrical capacity be brought to the site for operation. | Not designated agriculture. | Part of the highly sensitive Los Osos dune sands, home to the endangered Morro shoulderband snail, and several other sensitive species. Many snails were removed from the site during initial construction of the project. Habitat for the snail would easily return given the nature of the sandy soils. | Previously cleared for archaeological resources | Shallow groundwater table (although this varies because of slope); Soils and slopes suitable for construction; Proximate to presumed Strand B of Los Osos fault (disputed by Cleath & Associates) | The site is in town, and adjacent to the heavily traveled LOVR. Views of Morro Rock would be obscured by the treatment facilities. CCC report said net impact was beneficial because views to Morro Rock were opened up. | This site is proximate on three sides to developed land. Residential to the south and west, community facilities to the east. Three churches are nearby. | This site is central to the collection system. Because it lies within the area of collection, it is as efficient a location as would likely be found (i.e. no great advantage to any other site in town). It is as close to the Broderson disposal site as possible without going up the hill to the south. | The site is under the ownership of the LOCSD. Because of previous design, permitting and litigation efforts, it may have a shorter time required to begin construction. Tri-W requires mitigation for ESHA loss. | |

# SUMMARY OF VIABLE PROJECT ALTERNATIVES

## 7.1 INTRODUCTION

The detailed evaluation (fine screening) process to develop viable project alternatives was critical for this presentation of accurate and complete information needed by the Technical Advisory Committee, Assessment Engineer, and ultimately, Proposition 218 voters. During the detailed evaluation process, several key issues including costs and environmental/ permitting issues were examined to evaluate the potentially viable treatment components. Ultimately, the short-list of viable project alternatives that result from the fine screening process is governed by project configurations that are anticipated to be permitable, fundable and constructible.

Detailed evaluation information for potential components of viable alternatives to the Tri-W Project were presented in Chapters 2 through 6. This chapter examines combining the individual components into complete viable project alternatives (refer to the project flow schematic in Chapter 1). Components assembled into viable project alternatives include:

- Disposal/Reuse
- Collection
- Treatment (Liquid Stream) Technology
- Solids Treatment and Disposal
- Treatment Facility Siting

## 7.2 TRI-W PROJECT

As discussed in the Rough Screening Analysis (Carollo, March 2007) and in earlier sections of this report, the previous LOCSD project at the Tri-W site will continue to be carried through the fine screening process for comparison purposes as it meets the criteria of being permitable, fundable and constructible. Table 7.1 shows the components of the Tri-W project. The Tri-W project would provide Level 2 seawater intrusion mitigation (~285 AFY), with the addition of conservation and sprayfields for consistency with other alternatives and adequate disposal capacity.

Table 7.2 provides construction costs and operation and maintenance costs of the Tri-W project for comparison to viable project alternatives. The construction costs are primarily based on bid tabs from treatment facility and conveyance system bids on the project. For equivalent comparison, on-lot lateral costs developed in Chapter 3 of this report are included here since they are included in the other viable project alternatives.

**Table 7.1 Tri-W Project Components**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Disposal/Reuse Method | Collection System | Treatment Technology | Solids Treatment and Disposal Method | Treatment Facility Siting |
|---|---|---|---|---|
| Original Components | | | | |
| Leach Fields with Harvest Wells | Gravity System with Limited Low Pressure Collection | Membrane Bio-Reactor (MBR) | Hauling of Sub-Class B Biosolids | Tri-W Site |
| Components Required for Consistency with Other Alternatives | | | | |
| Sprayfield | | | | |
| Conservation | | | | |

**Table 7.2 Tri-W Project Construction Costs**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Project Element | Construction Costs ($M)(1) | Operations and Maintenance Costs ($M/year)(2) |
|---|---|---|
| On-Lot Lateral Costs(3) | $13 - 14 | – |
| Collection System | $68 | $0.7 |
| Treatment (Liquid and Solids) | $55 | $1.2 |
| Conservation | $1 | – |
| Disposal/Reuse | $7 - 9(4) | $0.3 |
| Harvest Disposal(5) | $12 - 13 | $0.1 - 0.2 |
| Treatment Facility Site | $1 - 3 | – |
| Miscellaneous Items(6) | $1 - 2 | $0.4 |
| Total Construction Costs | $158 - 165 | $2.7 - 2.8 |

Notes:
(1) Estimated Construction Costs based on bid tab values and escalated to April 2007 dollars.
(2) Final Project Report (Montgomery Watson Americas, March 2001) costs escalated to 2007 at 5% per year.
(3) Estimate based on costs developed in Chapter 3 of this report. Not included in original Tri-W design but included here for comparison to other viable project alternatives.
(4) Does not include disposal of harvest water.
(5) Includes a pipeline to Tonini Property and 100 acres of spray fields to dispose of harvest water. Not included in original Tri-W design but included here for comparison to other viable project alternatives.
(6) Construction costs include permitting/mitigation. O&M costs include water conservation, habitat mitigation, overhead, administration and contingency to correspond to the Final Project Report (Montgomery Watson Americas, March 2001) estimate.

The Tri-W project did not include adequate disposal capacity to meet the buildout flow. To make the comparison of the Tri-W project equivalent to the other viable project alternatives developed in this report, additional costs for routing flow to a spray field site is included.

## 7.3 ASSEMBLY OF ADDITIONAL VIABLE PROJECT ALTERNATIVES

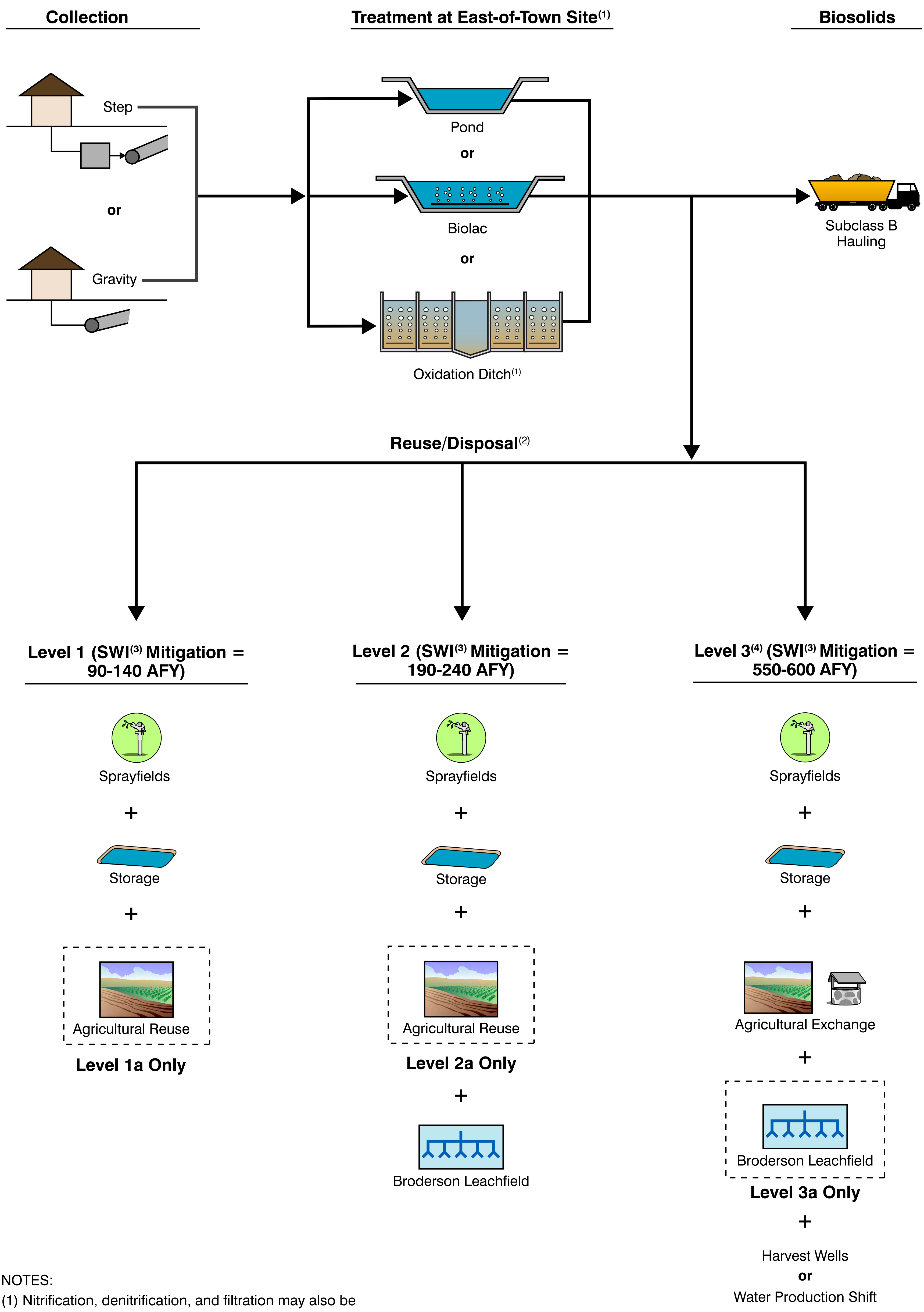
### 7.3.1 Additional Viable Project Alternatives

The rough screening report was the first step in developing alternatives to the Tri-W Project. The previous chapters in this Fine Screening Analysis each considered various alternative components and summarized the viable options to carry forward for development of additional viable project alternatives, as illustrated in Figure 7.1. Disposal and reuse alternatives were developed for meeting seawater intrusion mitigations at Level 1 and 2 using various combinations of spray disposal, agricultural reuse, leachfields at Broderson and conservation. Future phasing to a Level 3 project requires other groundwater management techniques to be implemented, which requires purveyor participation. Both Gravity and STEP/STEG collection are assumed to be viable for each alternative; however, effluent nitrogen levels may require additional treatment (nitrification and/or denitrification) for reuse/disposal alternatives requiring low nitrogen. Oxidation Ditches, Biolac and partially mixed facultative ponds are all carried forward as viable treatment technologies. Other treatment alternatives, such as extended aeration MLE, are feasible but were estimated to cost more than the best apparent alternatives and do not appear to offer any significant advantages. Sub-Class B solids treatment and hauling appears to be the low cost alternative and allows the community to develop composting/local recycling in the future. High priority sites were assumed viable for any of the alternatives and final selection should be based on considerations such as detailed geotechnical site evaluations, environmental compliance and land acquisition.

### 7.3.2 Combining Elements of Viable Project Alternatives

Combining the elements into viable project alternatives requires understanding the dependency between the disposal/reuse, treatment and collection systems. The choice of a disposal/reuse alternative decides the level of treatment needed. In turn, the choice of the collection system affects the processes needed to meet the required level of treatment. For example, the use of a STEP/STEG collection system decreases the need for secondary treatment. However, as the carbon into the plant is greatly lowered with a STEP/STEG collection system, meeting low nitrogen limits (denitrification) requires the addition of a carbon source (methanol), which increases treatment costs.

The viable reuse/disposal alternatives, treatment alternatives and collection system alternatives are shown combined in Table 7.3. Costs are shown in Table 7.3 for the treatment and solids facilities required for each disposal scenario and for each type of collection system. Solids are added into the costs to show the total treatment plant (liquid and solids) costs for each alternative. Solids costs for the pond alternatives are essentially zero for construction costs as the solids would be removed from the ponds at regular intervals using temporary, mobile equipment (included in operations and maintenance




NOTES:

(1) Nitrification, denitrification, and filtration may also be required to meet reuse/disposal water quality requirements.

(2) Although each of the reuse/disposal alternatives have many of the same components, the capacity of the components vary between projects.

(3) SWI = Sea Water Intrusion

(4) Level 3 can only be achieved with water purveyor participation which likely will extend the implementation time.

**Figure 7.1**
**VIABLE PROJECT ALTERNATIVES**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

**Table 7.3 Interrelationship of Disposal/Reuse, Treatment and Collection System**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Viable Project Alternative | Disposal/ Reuse Elements | Level of Treatment Required | Treatment and Solids System and Construction Costs (in millions) for Collection System Alternative[1,2,3] | |
|---|---|---|---|---|
| | | | **STEP** | **Gravity/Combined** |
| Level1a<br>140 AFY | Spray Fields<br>Ag Reuse<br>Conservation<br>Other Reuse<br>Storage (290 AF) | Tertiary<br>Low Nitrogen | Pond +N+D+F+S = $24.6 M<br>Biolac +D +F+S = $23.0 M<br>Ox Ditch +D+F+S = $25.3M | Pond +N+D+F+S = $26.1 M<br>Biolac +F+S = $23.1 M<br>Ox Ditch +F+S = $25.5 M |
| Level 1b<br>90 AFY | Spray Fields<br>Conservation<br>Storage (210 AF) | Secondary | Pond +S = $13.7 M<br>Biolac +S = $15.9 M<br>Ox Ditch +S = $18.2 M | Pond +S = $14.7 M<br>Biolac +S = $19.6 M<br>Ox Ditch +S = $22.0M |
| Level 2a<br>240 AFY | Spray Fields<br>Broderson<br>Ag Reuse<br>Conservation<br>Other Reuse<br>Storage (140 AF) | Tertiary<br>Low Nitrogen | Pond +N+D+F+S = $24.6 M<br>Biolac +D +F+S = $23.0 M<br>Ox Ditch +D+F+S = $25.3 M | Pond +N+D+F+S = $26.1 M<br>Biolac +F+S = $23.1 M<br>Ox Ditch +F+S = $25.5 M |
| Level 2b<br>190 AFY | Spray Fields<br>Broderson<br>Conservation<br>Storage (30 AF) | Secondary<br>Low Nitrogen | Pond +N+D+S = $20.6 M<br>Biolac +D+S = $19.5 M<br>Ox Ditch +D+S = $21.8 M | Pond +N+D+S = $22.1M<br>Biolac +S = $19.6 M<br>Ox Ditch+S = $22.0 M |
| Level 3a<br>590 AFY | Broderson<br>Ag Exchange<br>Harvest<br>Conservation<br>Other Reuse<br>Storage (115 AF) | Tertiary<br>Low Nitrogen | Pond +N+D+F+S = $24.6 M<br>Biolac +D +F+S = $23.0 M<br>Ox Ditch +D+F+S = $25.3 M | Pond +N+D+F+S = $26.1 M<br>Biolac +F+S = $23.1 M<br>Ox Ditch +F+S = $25.5 M |
| Level 3b<br>550 AFY | Spray Fields<br>Ag Exchange<br>Conservation<br>Other Reuse<br>Shift in Production (400 AF)<br>Storage (290 AF) | Tertiary<br>Low Nitrogen | Pond +N+D+F+S = $24.6 M<br>Biolac +D +F+S = $23.0 M<br>Ox Ditch +D+F+S = $25.3 M | Pond +N+D+F+S = $26.1 M<br>Biolac +F+S = $23.1 M<br>Ox Ditch +F+S = $25.5 M |
| Tri-W Project<br>~285 AFY | Broderson & Other<br>Leach Fields<br>Harvest<br>Spray Fields<br>Conservation | Tertiary<br>Low Nitrogen | N/A | MBR + S = $55.0M |

N/A - Not Available.[4]

Notes:

(1) Estimated Construction Costs for April 2007 including contractor overhead and profit and 30% design contingency (feasibility level estimate).
(2) Nitrification, denitrification and tertiary filtration of full plant flow assumed if applicable.
(3. N= Nitrification treatment)
D = Denitrification treatment
F = Filtration
S = Sub-Class B Biosolids
(4) Tri-W costs based on gravity collection system. Treatment Costs for the Tri-W Project with STEP collection are not available from bid tab information. Based on other treatment process costs, MBR costs associated with STEP collection could be approximately 10 to 15% less than when associated with a gravity collection system.

costs). Solids costs for oxidation ditch or Biolac assumes daily hauling of sub-class B biosolids.

Nitrification, denitrification, and filtration at full plant flow are included in Table 7.3 resulting in comparable treatment costs for gravity and STEP collection systems. Pond treatment is the lowest cost option for the Level 1b disposal alternative where nitrogen removal or tertiary treatment are not required. For all the other disposal alternatives, Biolac is the lowest cost, due to the expense of adding additional nitrification and denitrification after the ponds.

### 7.3.3 Environmental/Permitting Considerations

Each of the viable project alternatives will require permitting, mitigation monitoring, and land restoration. The following items should be factored into the cost comparison and considered during the pro/con analysis:

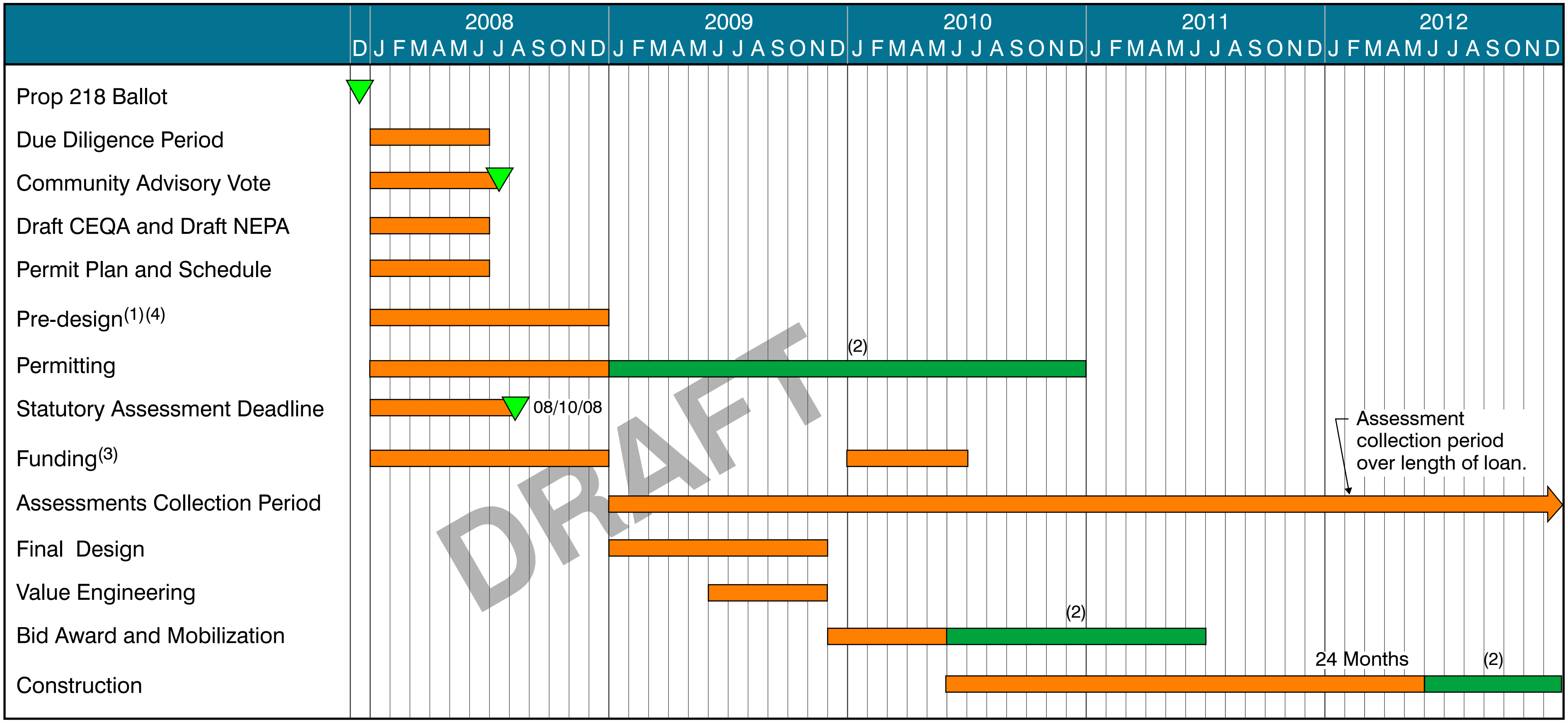
- Permitting - CEQA, Endangered Species Act (HCP or Section 7), Coastal Development Permit for all alternatives other than the Tri-W project, which is already permitted.
- Mitigation Monitoring - Much of the initial work for biological and archeological mitigation compliance was completed with the Tri-W project, and will be applicable to any of the alternatives, but additional costs will be incurred. The Broderson parcel is assumed to suffice as biological mitigation for any alternative.
- Land restoration - Disturbance of native habitat within the Los Osos dune sands will require restoration based upon a per acre disturbance.
- Litigation - All projects have been litigated to date, and all projects have had significant opposition. The cost is not estimated due to the uncertainty but may be substantial no matter which project alternative is ultimately selected by the community.

### 7.3.4 Schedule Considerations

Project schedule and cost were considered indirectly in the rough screening analysis. The screening approach removed components from consideration that were equivalent alternatives and potentially impeded implementation from a regulatory/permitting and public acceptance standpoint. The goal of the rough screening process was to eliminate those project components that had the greatest impact on project schedule and costs.

Figure 7.2 shows a preliminary project schedule believed to be achievable for each of the community options. The schedule is aggressive and includes numerous assumptions that need to be confirmed including:

- Federal funding is available.
- Habitat Conservation Plan (HCP) requirements do not significantly impact the permitting time frame.




NOTES:

1. Early predesign effort to support EIR, permitting and funding including interactions with water purveyors.
2. Permitting could be as short as 12 months or as long as 36 months to complete.
   Bid, award and construction would **not** take place until premitting task is complete.
3. Funding may take place in more than one phase.
4. DOES NOT include potential litigation.

**Figure 7.2**
**DRAFT PROJECT SCHEDULE[4]**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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- Competitive bidding and public contracting efforts are optimized for the project, including options on funding, for example, through private markets.
- The Draft Environmental Impact Report (EIR) will be completed by mid-2008 at which point a preferred treatment facility site will be identified.

## 7.4 COSTS FOR VIABLE PROJECT ALTERNATIVES

Using the lowest and highest treatment costs identified for each disposal alternative in Table 7.3, the total construction cost and total project cost ranges are developed in Table 7.4 for all elements of the projects including the collection system reuse/disposal, and siting.

**Table 7.4 Viable Project Alternatives Range of Costs, Millions[1]**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Project Element | | Seawater Intrusion Mitigation Level 1 | | Seawater Intrusion Mitigation Level 2 | | Seawater Intrusion Mitigation Level 3 | | Tri-W Project |
|---|---|---|---|---|---|---|---|---|
| | | 90 AFY | 140 AFY | 190 AFY | 240 AFY | 550 AFY | 600 AFY | ~285 AFY |
| Collection System | STEP | $65 - 81 | $65 - 81 | $65 - 81 | $65 - 81 | $65 - 81 | $65 - 81 | $N/A |
| | Gravity[7] | $83 - 90 | $83 - 90 | $83 - 90 | $83 - 90 | $83 - 90 | $83 - 90 | $81 - 82 |
| Treatment (Liquid and Solids) [2] | STEP | $14 - 18 | $23 - 25 | $20 - 22 | $23 - 25 | $23 - 25 | $23 - 25 | N/A[8] |
| | Gravity | $15 - 22 | $23 - 26 | $20 - 22 | $23 - 26 | $23 - 26 | $23 - 26 | $55 |
| Disposal/Reuse | | $13 - 16 | $13 - 14 | $15 - 17 | $13 - 14 | $26 - 30 | $26 - 27 | $20 - 23 |
| Treatment Facility Site[3] | | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 | $1 - 3 |
| Permitting/Mitigation[4] | | $1 - 2 | $1 - 2 | $1 - 2 | $1 - 2 | $1 - 2 | $1- 2 | $1 - 2 |
| Total Construction Costs | STEP | $94-120 | $103 -126 | $102-125 | $103-126 | $116-142 | $116-139 | N/A |
| | Gravity | $113-132 | $121-135 | $120-134 | $122-135 | $135-151 | $134-148 | $158 - 165 |
| Total Construction Costs Escalated to Mid-Point of Construction[5] | STEP | $117-150 | $128-157 | $126-156 | $129-157 | $144-176 | $144-173 | N/A |
| | Gravity | $141-164 | $151-168 | $149-167 | $152-168 | $168-188 | $167-184 | $197 - 205 |
| Project Costs[6] | STEP | $18-24 | $18-24 | $18-24 | $18-24 | $21-26 | $21-26 | N/A |
| | Gravity | $16-21 | $16-21 | $16-21 | $16-21 | $19-23 | $19-23 | $12 - 17 |
| Total Project Costs[5] | STEP | $135-174 | $146-181 | $144-180 | $147-181 | $166-202 | $165-199 | N/A |
| | Gravity | $157-185 | $167-189 | $165-188 | $168-189 | $187-211 | $186-207 | $209 - 222 |

N/A - Not Available.
Notes:
(1) Estimated Construction Costs in April 2007 dollars including contractor overhead and profit and 30% design contingency (feasibility-level estimate).
(2) From Table 7.3 - shows combined costs of liquid treatment and solids treatment/disposal.
(3) Assumes approximately 40 acres acquired, except for Tri-W Project. Actual acreage may vary depending on the final site and plant configuration.
(4) Costs do not include land restoration costs at $20,000 to $50,000 per acre.
(5) Assumes mid-point of construction is June 2011. Escalation at 24.5% of construction cost sub-total per the Basis of Cost Evaluation (Carollo Engineers, May 2007).
(6) Project costs include design, construction management, administration and legal costs, as detailed in the Basis of Cost Memorandum in Appendix C.
(7) Cost do not include $13 to 25 million for electrical connection premium for separate electrical service that may be incurred if permitting and/or funding requirements stipulate this requirement and the funding is pursued.
(8) Tri-W costs based on gravity collection system. Treatment Costs for the Tri-W Project with STEP collection are not available from bid tab information. Based on other treatment process costs, MBR costs associated with STEP collection could be approximately 10 to 15% less than when associated with a gravity collection system.

All of the cost estimates include an inflation factor to account for the estimated escalation of costs from February 2007 (basis of cost estimates in this Fine Screening Report) to the mid-point of construction, currently scheduled for June 2011. The estimated project inflation through June 2011 represents essentially a six-year inflation period since previous 2005 cost estimates and bids.

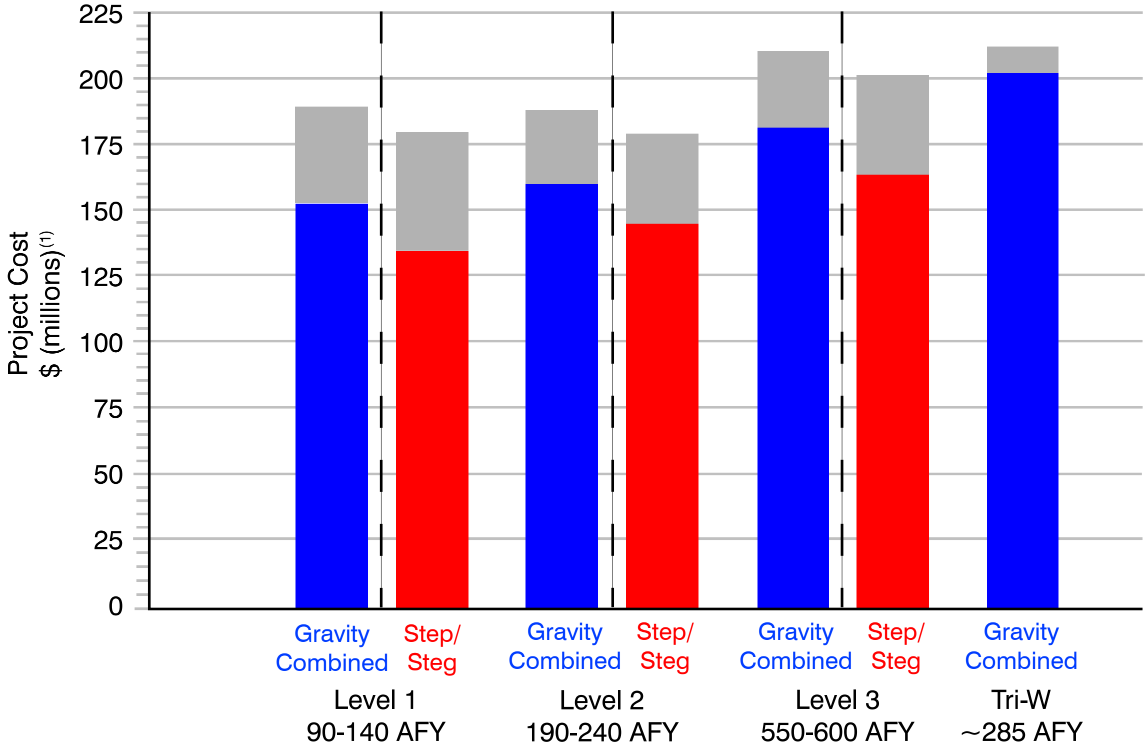
The construction costs developed in previous chapters are based on current construction costs. Escalation of costs to the mid-point of construction is necessary to account for inflation. Escalation of construction costs to the mid-point of construction of June 2011 developed above is included in Table 7.4. In addition to the construction costs, there are project costs that would be incurred such as costs for design, construction management, legal, and administrative. The total construction and project costs are shown graphically in Figure 7.3. Total construction cost information includes Tri-W costs summarized in Table 7.2.

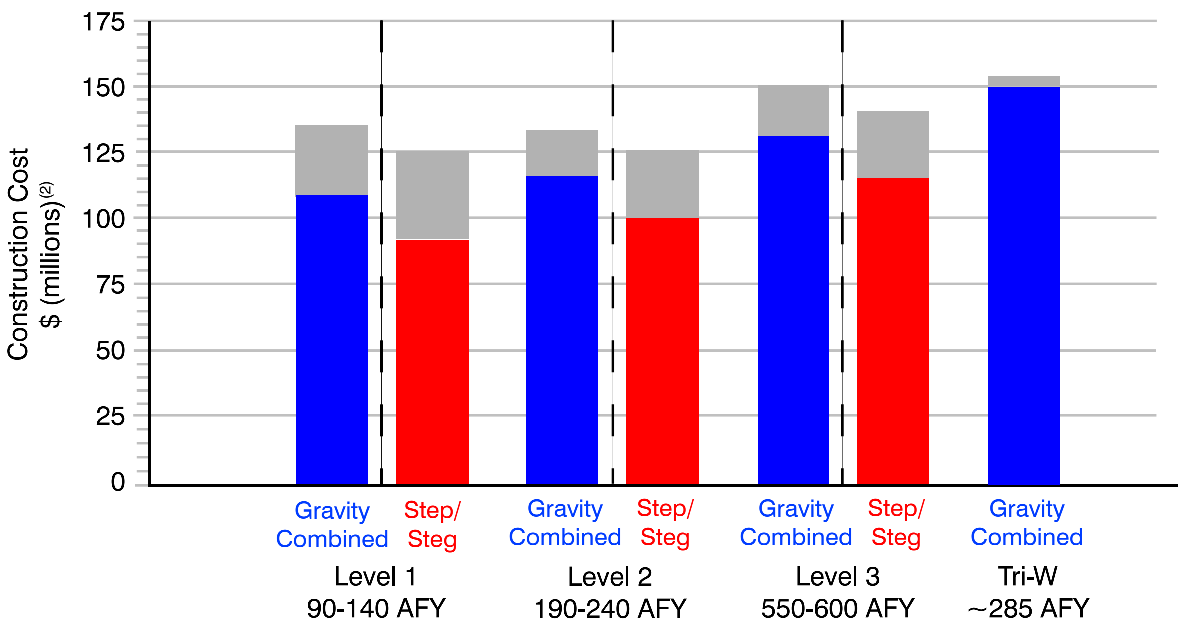
As can be seen from Table 7.4 the construction costs for the various alternatives of seawater intrusion all have similar cost ranges. This is further shown in Figure 7.3. So the choice of what level of seawater intrusion to strive for is not an obvious choice and will depend on the community's preference for type of disposal/reuse. While the costs for the Level 3 projects is comparable to the costs for the other levels of mitigation, the level three projects require water purveyor participation which may require additional time to implement. Therefore, Level 3 is considered to be a future phase project and not a viable project alternative at this time.

Other costs that are important to consider are the operations and maintenance costs that will be an annual on-going expense. The operations and maintenance costs for each of the additional VPAs developed in this analysis are shown in Table 7.5.

#### 7.4.1.1 Summary of VPA Costs and Project Delivery Options

The range of costs for each alternative are shown in this section. The range of costs versus mitigation are shown in Figure 7.4. This range is largely driven by the range of cost associated with the construction of the sewer system and the unknowns associated with the cost estimates. To deal with this issue of the unknown collection system costs, the County has proposed an alternate delivery process for the collection system that will enable competitive bidding of the STEP/STEG system and the gravity/combined system. Detailed construction and O&M costs for both collection systems would then be available. When combined with the costs for other elements of the project, the most cost effective project alternative could be determined without pre-determining the collection system at this time.




(1) Costs include escalation to mid-point of construction, and project costs (i.e., legal, administrative, design, etc.).

(2) Construction costs only, 2007 dollars.

**Figure 7.3**
**ESTIMATED PROJECT AND CONSTRUCTION COSTS FOR VIABLE PROJECT ALTERNATIVE**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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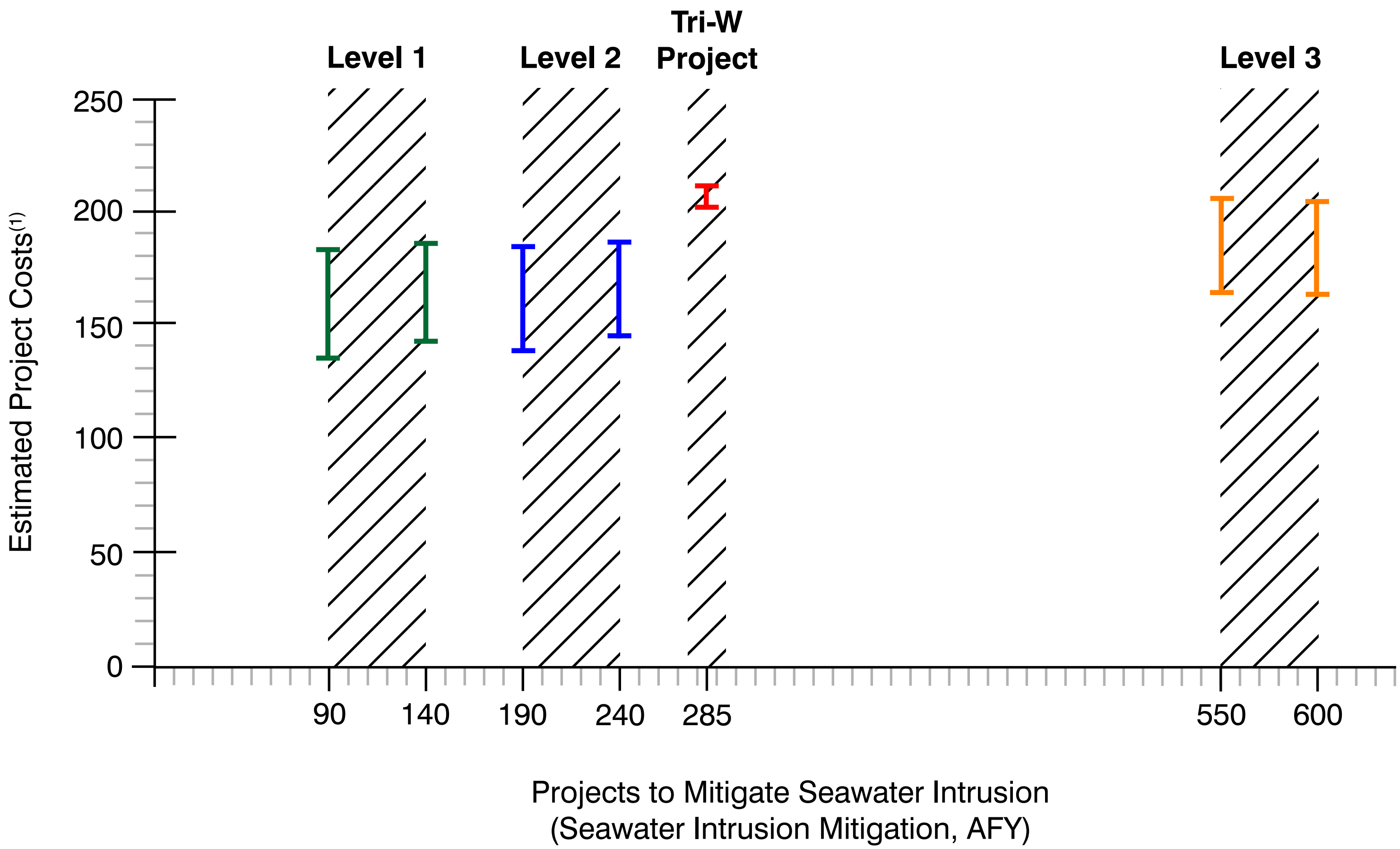
| **Table 7.5** | | **Viable Project Alternatives Range of O&M Costs, Millions[1]<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Project Element** | | **Seawater Intrusion Mitigation Level 1** | | **Seawater Intrusion Mitigation Level 2** | | **Seawater Intrusion Mitigation Level 3** | | **Tri-W Project** |
| | | **90 AFY** | **140 AFY** | **190 AFY** | **240 AFY** | **550 AFY** | **600 AFY** | **~285 AFY** |
| Collection System | STEP<br>Gravity | $0.8<br>$0.5 | $0.8<br>$0.5 | $0.8<br>$0.5 | $0.8<br>$0.5 | $0.8<br>$0.5 | $0.8<br>$0.5 | N/A<br>$0.7 |
| Treatment | STEP<br>Gravity | $0.5-0.6<br>$0.5-0.7 | $0.9-1.8<br>$0.8-1.8 | $0.8-1.7<br>$0.7-1.7 | $0.9-1.8<br>$0.8-1.8 | $0.9-1.8<br>$0.8-1.8 | $0.9-1.8<br>$0.8-1.8 | N/A[4]<br>$0.7 |
| Solids (Sub Class B)[2] | STEP<br>Gravity | $0.03-0.3<br>$0.04-0.5 | $0.03-0.3<br>$0.04-0.5 | $0.03-0.3<br>$0.04-0.5 | $0.03-0.3<br>$0.04-0.5 | $0.03-0.3<br>$0.04-0.5 | $0.03-0.3<br>$0.04-0.5 | N/A<br>$0.5 |
| Disposal/ Reuse | STEP<br>Gravity | $0.1-0.3<br>$0.1-0.3 | $0.1-0.2<br>$0.1-0.2 | $0.4<br>$0.4 | $0.4<br>$0.4 | $0.1-1.1<br>$0.1-1.1 | $0.3<br>$0.3 | N/A<br>$0.4 - 0.5 |
| Total O&M Costs | STEP<br>Gravity | $1.4 - 1.9<br>$1.1 - 1.9 | $1.8 - 3.0<br>$1.4 - 2.9 | $2.0 - 3.1<br>$1.6 - 3.0 | $2.1 - 3.2<br>$1.7 - 3.2 | $1.8 - 3.9<br>$1.4 - 3.8 | $2.0 - 3.1<br>$1.6 - 3.0 | N/A<br>$2.3 - 2.4[3] |

N/A - Not Available.
Notes:
(1)Estimated O&M Costs in April 2007 dollars.
(2) Low costs are based on an annuity to fund temporary, mobile facilities for removal of solids from facultative ponds 20 years following startup of the wastewater treatment facilities.
(3) Does not include $0.4 million for water conservation, habitat mitigation, overhead, administration and contingency included in the Final Project Report (Montgomery Watson Americas, March 2001) estimate. See Table 7.2.
(4) Tri-W costs based on gravity collection system. Treatment Costs for the Tri-W Project with STEP collection are not available from bid tab information. Based on other treatment process costs, MBR costs associated with STEP collection could be approximately 10 to 20% less than when associated with a gravity collection system.

## 7.5 NEXT STEPS

The objective of this report was to perform a fine screening analysis of project components for assembly into additional project alternatives, assuming that the Tri-W Project is a viable project alternative. The next steps of the project development process are as follows:

1. County staff report prepared and presented to the Board of Supervisors for approval prior to the Board's direction to proceed with a Proposition 218 ballot (late Summer 2007).
2. Assessment engineer and the County will identify "special benefits" of the project for the Proposition 218 ballot (Summer/Fall 2007).
3. Proposition 218 ballot (Fall 2007).




(1) Costs include escalation to mid point of construction and project costs (legal, administrative, design, etc.)

**Figure 7.4**
**COMPARISION OF VPA COST VS. MITIGATION**
LOS OSOS WASTEWATER PROJECT DEVELOPMENT
SAN LUIS OBISPO COUNTY

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APPENDIX A

# EFFLUENT REUSE/DISPOSAL CAPITAL AND O&M COSTS

**Table A1** **Capital Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Spray field acres | Base Costs | 30% contingency | Cost Subtotal | Notes |
|---|---|---|---|---|---|
| **Level 1a** | 170 | | | | |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| Piping to Spray Field | | $1,082,000 | $325,000 | $1,410,000 | 2 |
| Spray Field Storage | | $2,164,000 | $649,000 | $2,810,000 | 3 |
| Spray Field Maintenance Machinery | | $1,306,000 | $392,000 | $1,700,000 | 4 |
| Pump Station | | $600,000 | $180,000 | $780,000 | 5 |
| Spray Field Development | | $35,000 | $11,000 | $50,000 | 6 |
| Ag Piping | | $899,000 | $270,000 | $1,170,000 | 7 |
| Ag Storage | | $52,000 | $16,000 | $70,000 | 8 |
| Land Acquisition | | $5,100,000 | $0 | $5,100,000 | 9 |
| ***Total w/ Spray Field Maintenance*** | | | | **$14,380,000** | |
| ***Total w/o Spray Field Maintenance*** | | | | **$12,680,000** | |
| **Level 1b** | 280 | | | | |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| Piping To Spray Field | | $1,198,000 | $360,000 | $1,560,000 | 2 |
| Spray Field Storage | | $1,589,000 | $477,000 | $2,070,000 | 10 |
| Spray Field Maintenance Machinery | | $2,152,000 | $646,000 | $2,800,000 | 4 |
| Pump Station | | $600,000 | $180,000 | $780,000 | 5 |
| Spray Field Development | | $58,000 | $17,000 | $80,000 | 6 |
| Land Acquisition | | $7,000,000 | | $7,000,000 | 9 |

**Table A1** **Capital Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Spray field acres | Base Costs | 30% contingency | Cost Subtotal | Notes |
|---|---|---|---|---|---|
| ***Total w/Spray Field Maintenance*** | | | | **$15,590,000** | |
| ***Total w/o Spray Field Maintenance*** | | | | **$12,790,000** | |
| | | | | | |
| **Level 2a** | 70 | | | | |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| Piping to Spray Field | | $1,082,000 | $325,000 | $1,410,000 | 2 |
| Spray Field Development | | $15,000 | $4,000 | $20,000 | 3 |
| Spray Field Maintenance Machinery | | $538,000 | $161,000 | $700,000 | 4 |
| To Ag & Leachfield Piping | | $2,254,000 | $676,000 | $2,930,000 | 11 |
| Onsite Storage | | $1,100,000 | $330,000 | $1,430,000 | 12 |
| Pump Station (2) | | $1,200,000 | $360,000 | $1,560,000 | 5 |
| Ag Storage | | $52,000 | $16,000 | $70,000 | 8 |
| Leach Field Development | | $2,367,000 | | $2,370,000 | 13 |
| Land Acquisition | | $2,100,000 | | $2,100,000 | 9 |
| ***Total w/Spray Field Maintenance*** | | | | **$13,880,000** | |
| ***Total w/o Spray Field Maintenance*** | | | | **$13,180,000** | |
| | | | | | |
| **Level 2b** | 180 | | | | |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| Piping to Spray Field | | $1,268,000 | $380,000 | $1,650,000 | 2 |

**Table A1** **Capital Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Spray field acres | Base Costs | 30% contingency | Cost Subtotal | Notes |
|---|---|---|---|---|---|
| Spray Field Development | | $37,000 | $11,000 | $50,000 | 3 |
| Spray Field Maintenance Machinery | | $1,383,000 | $415,000 | $1,800,000 | 4 |
| Onsite Storage | | $308,000 | $93,000 | $400,000 | 14 |
| Pump Station | | $1,200,000 | $360,000 | $1,560,000 | 5 |
| To Leach Field Piping | | $1,666,000 | $500,000 | $2,170,000 | 15 |
| Leach Field Development | | $2,367,000 | | $2,370,000 | 13 |
| Land Acquisition | | $5,400,000 | | $5,400,000 | 9 |
| ***Total w/Spray Field Maintenance*** | | | | **$16,690,000** | |
| ***Total w/o Spray Field Maintenance*** | | | | **$14,890,000** | |
| **Level 3a** | 60 | | | | |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| Piping To Spray Field | | $930,000 | $279,000 | $1,210,000 | 2 |
| Spray Field Development | | $17,000 | $5,000 | $20,000 | 3 |
| Spray Field Land Acquisition | | $1,800,000 | | $1,800,000 | 9 |
| Onsite Storage | | $918,000 | $275,000 | $1,190,000 | 16 |
| Spray Field Maintenance Machinery | | $1,306,000 | $392,000 | $1,700,000 | 4 |
| Ag & Leachfield Piping | | $2,254,000 | $676,000 | $2,930,000 | 11 |
| Ag Storage | | $52,000 | $16,000 | $70,000 | 8 |
| Ag Land Acquisition | | $9,200,000 | | $9,200,000 | 17 |

**Table A1** **Capital Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Spray field acres | Base Costs | 30% contingency | Cost Subtotal | Notes |
|---|---|---|---|---|---|
| Ag Exchange Wells [(4)] | | $715,000 | $215,000 | $930,000 | 18 |
| Pump Station | | $1,200,000 | $360,000 | $1,560,000 | 5 |
| Leach Field Development | | $2,366,940 | | $2,370,000 | 13 |
| Harvest Treatment Facility | | $160,000 | $48,000 | $210,000 | 19 |
| Harvest Wells | | $1,440,000 | | $1,440,000 | 20 |
| Water Main | | $916,000 | $458,000 | $1,370,000 | 21 |
| ***Total w/ Spray Field Maintenance*** | | | | **$27,300,000** | |
| ***Total w/o Spray Field Maintenance*** | | | | **$25,600,000** | |
| **Level 3b** | 170 | | | | |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| Piping to Spray Field | | $1,082,000 | $325,000 | $1,410,000 | 2 |
| Spray Field Storage | | $2,164,000 | $649,000 | $2,810,000 | 22 |
| Pump Station | | $600,000 | $180,000 | $780,000 | 5 |
| Spray Field Development | | $35,000 | $11,000 | $50,000 | 3 |
| Spray Field Maintenance Machinery | | $1,306,000 | $392,000 | $1,700,000 | 4 |
| Ag Piping | | $899,000 | $270,000 | $1,170,000 | 7 |
| Ag Storage | | $52,000 | $16,000 | $70,000 | 8 |
| Ag Exchange Wells [(4)] | | $715,000 | $215,000 | $930,000 | 18 |
| Ag Land Acquisition | | $9,200,000 | | $9,200,000 | 17 |

**Table A1** **Capital Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Spray field acres | Base Costs | 30% contingency | Cost Subtotal | Notes |
|---|---|---|---|---|---|
| Spray Field Land Acquisition | | $5,100,000 | | $5,100,000 | 9 |
| Upper Aquifer Harvest Treatment | | $320,000 | $96,000 | $420,000 | 19 |
| Harvest Wells | | $1,440,000 | | $1,440,000 | 70 |
| Water Main | | $916,000 | $458,000 | $1,370,000 | 21 |
| Water Importation Pipe | | $2,600,000 | $1,300,000 | $3,900,000 | 22 |
| ***Total w/ Harvest Wells w/o Spray Field Maintenance*** | | | | **$26,050,000** | |
| ***Total W/Harvest Wells and Spray Field Maintenance*** | | | | **$27,750,000** | |
| ***Total w/ Importation and w/o And Spray Field Maintenance*** | | | | **$28,090,000** | |
| ***Total w/ Importation And Spray Field Maintenance*** | | | | **$29,790,000** | |
| **Tri-W Project** | 100 | | | | |
| Original Project Bid Tabs - low | | $7,180,000 | | $7,180,000 | 13 |
| Original Project Bid Tabs - high | | $9,210,000 | | $9,210,000 | 13 |
| Conservation | | $1,000,000 | $300,000 | $1,300,000 | 1 |
| *Add-ons for disposal of Harvest Water* | | | | | |
| piping to spray field | | $2,654,000 | $796,000 | $3,450,000 | 2, 15 |

**Table A1 Capital Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Spray field acres | Base Costs | 30% contingency | Cost Subtotal | Notes |
|---|---|---|---|---|---|
| spray field maintenance machinery | | $768,000 | $231,000 | $1,000,000 | 4 |
| pump station | | $600,000 | $180,000 | $780,000 | 5 |
| spray field development | | $21,000 | $6,000 | $30,000 | 6 |
| land aquistion | | $7,000,000 | | $7,000,000 | 9 |
| ***Total - Low (w/o Spray Field Maintenance)*** | | | | **$19,740,000** | |
| ***Total - High (w/ Spray Field Maintenance)*** | | | | **$22,770,000** | |

**Notes:**
(1) 5000 toilets at $200 each.
(2) 10500 ft from plant to Tonini.
(3) 290 AF.
(4) $256/acre/year for 30 years
(5) See costs in treatment plant information.
(6) $209/acre.
(7) 9000 ft from plant to ag wells.
(8) One day storage - 2.6 AF.
(9) $30,000/acre for spray fields, capped at $7m (price of Tonini Ranch).
(10) 210 AF.
(11) Piping to ag well combined with 17700 ft from plant to Broderson.
(12) 140 AF.
(13) Based on bid tabs for Tri-W project.
(14) 30 AF.
(15) 17700 ft from plant to Broderson.
(16) 115 AF.
(17) $40,000/acre for 230 acres, not including income from leases to farmers.
(18) $197,340 each for 4.
(19) From blueh2o quote.
(20) Based on bid tabs for Tri-W project.
(21) New pipe installed along LOVR from Broderson Ave. to Eto Ln. (50% contingency).
(22) 5.5 mile pipe from Morro Bay to Los Osos.

| **Table A2** | **O&M Costs for Reuse/Disposal Projects<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** | | |
|---|---|---|---|
| | | | **Notes** |
| **Level 1a** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $67,000 | $104,000 | 1 |
| Labor | $0 | $54,000 | 2 |
| *Ag Reuse* | | | |
| Energy | $34,000 | $34,000 | 3 |
| ***Total*** | **$101,000** | **$192,000** | |
| **Level 1b** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $125,000 | $187,000 | 1 |
| Labor | $0 | $89,000 | 2 |
| ***Total*** | **$125,000** | **$276,000** | |
| **Level 2a** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $86,000 | $102,000 | 1 |
| Labor | 0 | $22,000 | 2 |
| *Ag Reuse* | | | |
| Energy | $34,000 | $34,000 | 3 |
| *Leachfields* | | | |
| Energy | $160,000 | $160,000 | 4 |
| Labor | $90,000 | $90,000 | 5 |
| ***Total*** | **$370,000** | **$410,000** | |
| **Level 2b** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $86,000 | $126,000 | 1 |
| Labor | 0 | $60,000 | 2 |
| *Leachfields* | | | |
| Energy | $160,000 | $160,000 | 4 |
| Labor | $90,000 | $90,000 | 5 |

| **Table A2** | **O&M Costs for Reuse/Disposal Projects<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** | | |
|---|---|---|---|
| | | | **Notes** |
| ***Total*** | **$340,000** | **$430,000** | |
| **Level 3a** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $6,000 | $8,000 | 1 |
| Labor | $0 | $3,000 | 2 |
| *Ag Reuse* | | | |
| Energy | $34,000 | $34,000 | 3 |
| *Leachfields* | | | |
| Energy | $170,000 | $170,000 | 4 |
| Labor | $90,000 | $90,000 | 5 |
| *Harvest Wells* | | | |
| Energy | $9,000 | $9,000 | 6 |
| Treatment | $6,000 | $6,000 | 7 |
| ***Total*** | **$315,000** | **$320,000** | |
| **Level 3b** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $67,000 | $104,000 | 1 |
| Labor | $0 | $54,000 | 2 |
| *Ag Reuse* | | | |
| Energy | $44,000 | $44,000 | 3 |
| *Harvest Wells* | | | |
| Energy | $9,000 | $9,000 | 6 |
| Treatment | $13,000 | $13,000 | 7 |
| Water Importation | | | |
| Energy | $329,000 | $329,000 | 8 |
| Water Cost (low) | $400,000 | $400,000 | 9 |
| Water Cost (high) | $600,000 | $600,000 | 9 |
| ***Total Harvest*** | **$133,000** | **$224,000** | |
| ***Total Import (High)*** | **$840,000** | **$931,000** | |
| ***Total Import (Low)*** | **$1,040,000** | **$1,131,000** | |

**Table A2** **O&M Costs for Reuse/Disposal Projects**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | | | **Notes** |
|---|---|---|---|
| **Tri-W Project** | | | |
| *Spray Fields* | *Without Harvest* | *With 6 Harvests/Yr* | |
| Energy | $68,000 | 84,000 | 1 |
| Labor | 0 | 32,000 | 2 |
| *Leachfields* | | | |
| Labor | $90,000 | $90,000 | 11 |
| Energy | $160,000 | $160,000 | 11 |
| *Harvest Wells* | | | |
| Energy | $9,000 | $9,000 | 6 |
| ***Total*** | **$320,000** | **$370,000** | |

Notes:
(1) Energy from pumping plus fuel for spray field maintenance machinery.
(2) Labor for spray field maintenance - $40/hr.
(3) Energy from pumping to ag land.
(4) Energy from pumping an leachfield maintenance.
(5) Labor for leachfield maintenance - $60/hr.
(6) Energy to pump harvest water.
(7) Annual treatment expense, provided by blueh2o.
(8) Energy to pump imported water from Morro Bay.
(9) Range of imported water costs: $1000-1500/AF.

Appendix B

# THOMA ELECTRIC MEMORANDUM

May 30, 2007

# ELECTRICAL SYSTEMS EVALUATIONS
# FOR CONSIDERATION OF PROPOSED
# SEPTIC TANK EFFLUENT PUMPING (STEP) SYSTEM

## INTRODUCTION

This study has been commissioned by San Luis Obispo County for our firm to evaluate the feasibility of implanting a Septic Tank Effluent Pumping (STEP) system. As outlined in our proposal to the County, our goal is to determine what various electrical requirements might be and attempt to develop the basic costs associated with these requirements. The following discussion will identify a number of issues that the implementation may encounter, but to also give a rough order of magnitude to the costs on a per residence basis.

## FINDINGS AND RESULTS

We met with County representative John Waddell and Mr. Rob Miller of the Wallace Group in order to obtain an understanding of the basic scope of implementing the STEP system on a typical residence. It was related to us, that project funding by the State Water Board may require that a "separate power drop" to each residence be provided for the electrical controls and electrical pumping system (between ½ hp and 1 hp) for the STEP sewer system. It was Mr. Waddell and Mr. Miller's understanding that the State intended a "separate power drop" to be defined as a separate utility company meter and distribution system.

Since the loads being added are very small, and the hours of operation per day are very limited, the overall added load to the utility distribution system would appear to be negligible. However, the addition of a second meter to every household in the CSD area in question (approximately 4,400 residences) is a very significant undertaking. We collectively identified numerous options that may exist and that our task would be to explore the feasibility of adding a second electric meter at each residence as well as develop the cost components of that implementation.

We immediately engaged PG&E to review the two options that required their involvement, since a second meter addition must meet the CPUC rule allowances as well as PG&E requirements and to determine what appropriate tariffs would apply. We have attached a copy of that communication in Appendix A along with the e-mail response that ultimately followed indicating that our proposed solutions can be done and a cost for each condition. Although the e-mail is relatively short and to the point (e-mail from Robert Burke of PG&E), there were numerous telephone conversations and a meeting at PG&E to discuss the proposed project and the two primary prototype concepts. PG&E has provided these evaluations and provided “conceptual” costs only as a courtesy to the County. Since a formal application has not been submitted, there is no project for them to evaluate in detail. They also cannot commit to engineering time without a contract or engineering advance deposit to cover their expenses of evaluation. Whether the project would be considered one overall application in the future, or individual resident by resident applications could alter PG&E costs significantly. The have determined that these scenarios are in fact possible and are based on current rules and subject to change. The costs in the PG&E reply, are only statements of possible/potential construction cost. With the limited time available to process this request, and their availability of resources, we are pleased and appreciative that our request was accommodated and can be reported herein. These costs are only the PG&E costs associated with rearranging their facilities. The customer (or whatever agency contracts for said work) must make all accommodations for the metering equipment, power for distribution, grounding, trenching, conduit, power and controls to effluent tank, etc. are all in addition to the PG&E work.

As previously stated, there are several basic conditions that we felt collectively would be encountered at a typical residence. The study was limited to residential units. Although there are variations within each condition, we will describe those conditions likely to be found below. With that information, an estimate of the number of units falling into each category can be determine and subsequently a total project cost. The two conditions evaluate which involve PG&E are described below:

<u>Condition</u>

1. Overhead PG&E electrical service drop to a weatherhead and on exterior meter with a main circuit breaker. A review of our sketch forwarded to PG&E in Exhibit A Detail 1 and included for reference again in Appendix B shows a simple solution that will allow for a separate 100 amp meter on a single family residence with one existing meter. This solution would be an overhead drop from rear property line or from front of residence at street.

2. An underground service is one that is with the PG&E conductors in a conduit, below grade to a customer owned meter at the residence. Again, a sketch of an underground option for adding a second meter has been proposed. It should be noted here, that PG&E will not bring a second service lateral conduit into a building except within allowed exceptions, none of which apply to this application. Each residence is entitled to only one service lateral. The detail for this option is in sketch 2 and 3 attached to the PG&E letter as well as Appendix B for

convenience. This condition nearly always (with few if any exceptions) extends from the street into a residential property. These conditions were explored, one with a 100 amp existing meter and one with an existing 200 amp meter, which are the conditions we should expect to find.

These two conditions have a variety of factors that are likely to come into play in most cases that can or will affect construction costs. Those conditions or concerns and questions are listed in Appendix B and must be addressed as a cost for the overall project. As a result of one area observation “drive around”, all of the issues in Appendix B will be encountered throughout the community at some level. These are significant issues that may need further evaluation.

The two options above only describe the utility component of the project and not the electrical connection between the STEP control box and the STEP submersible pump within the tank. There are numerous options where a tank might be placed on a residential property. In some cases, it will be on the opposite side of a driveway from the meter and control panel or various site conditions could apply to the difficulty with the extending power and control to the tank. There will obviously be varying distances from electrical panel to tank as well. For that reason our cost model in Appendix C contains options for this length.

One other last option that we agreed to evaluate, was one that does not include PG&E, but one that would simply add a small subpanel at the exterior of the residence, and add the control panel and submersible pump circuit to the existing meter. This option is depicted in a sketch number 4 in Appendix B for convenience. Although the definition of “separate power drop” was defined to us as a separate meter, a separate distribution panel on the same customer meter would be possible in the majority of properties encountered. This option has been priced as well, for consideration, as it is significantly less expensive, and less aesthetically impacting. This option assumes that a ½ hp to 1 hp meter would be able to be added to an existing meter based on the residence’s existing use and calculated load. This load calculation would need to be completed for each and every residence, in order to meet County Building Department requirements.

STATEMENTS OF PROBABLE CONSTRUCTION COSTS

We have prepared a matrix of cost information based on very detailed costing of the three options that are intended to provide you with the data you need to create an overall project cost for the entire service area. See Appendix C for this matrix of costs. The various options are inclusive of the PG&E rearrangement costs that were related to us by Robert Burke. PG&E indicated to us that if more than one residence per day were to be "cutover" to a new meter, that their overall cost per unit might be reduced due to efficiency, but this method of implementation has not been confirmed to us. We have used the conservative cost of one at a time. The cost of trenching is included for several lengths of distance from panel to septic tank.

We also discussed the concern that at least 40 to 50% of the properties will have an electrical service on one side of the residence, and there will be a need to cross that driveway with the power and control wiring in underground conduit. We contacted a boring company and obtained an estimate of $2,500 per single driveway, if they must set up for only one at a time. This firm indicated that they were capable of doing 4-5 per day which would bring the cost per driveway to approximately $500 each. The inclusion of this cost becomes a matter of how the project could or would be implemented. In our opinion, saw cutting and patching driveways is not a viable option based on the number of variations in driveways. We have shown both options in Appendix C.

The issues related to and the costs associated with the items in Appendix B are not included herein but should be factored into the planning and budgeting.

Many of these issues are homeowner driven and not easily prototyped for a cost. In individual cases, these options may not even be viable. We were not charged with completing a residence by residence audit, therefore, this cost is difficult to model within this report.

The costs of all items in Appendix C matrix were priced in detail with the exception of "Appendix B" factors, which could be a range of numbers and therefore must be added based on assumptions.

The last page of Appendix C is a possible scenario with assumptions as to the quantity breakdown of different conditions projected against the unit costs that were developed. We have made some estimated projections as to the Appendix B potential impacts (these are very rough estimates). The total cost of this scenario is still subject to an audit of the various applicable costs, but is likely to be reasonable statement of overall probable cost. These costs do not include inflation, or contingency and should be adjusted accordingly.

CONCLUSION

We have made every attempt to identify the challenges of implementing the STEP system from an electrical point of view. The cost model matrix has been developed as a tool for your use. The one scenario recap we have prepared for the total project cost and included at the end of Appendix C, is only that, a single possible scenario. It is subject to a system audit to determine the applicability of the costs and models for costs developed.

It must also be noted that the third conditional alternative we considered, that did not involve a new meter, or PG&E involvement, and does not require ongoing monthly meter charges into the future, is less than half the cost and reduces the negative visual impacts. Many existing meters are flush mounted into an exterior wall. The new metering is anticipated to be surface mounted and not aesthetically desirable. The third alternative would be the lowest cost and least impacting to the residential property.

We hope this study provides you with the information that you need in order to move forward with your important decisions on the project.

# APPENDIX A

**thoma** ENGINEERING

April 5, 2007

PG&E
4325 South Higuera Street
San Luis Obispo, CA 93401

Attn: Bob Burke/J.T. Haas

Subject: Study to evaluate the feasibility and costs associated with Septic Tank Effluent Pumping (STEP) System for County of San Luis Obispo relative to Los Osos.

Dear Sirs:

Pursuant to our telephone conversation yesterday, I am formalizing our request via this letter for your consideration. Our firm has been hired to evaluate the feasibility of providing electrical services to support a particular sewer solution in Los Osos, that being (STEP). I am sure you are aware of the difficulty that has been experienced in Los Osos with the implementation of a new sewer system. The concept that we have been asked to explore, is being recommended by the State. Along with their request, has come the requirement that any electrical needs associated with powered equipment, be accomplished by way of a "separate power drop". The County of SLO who has hired us, is asking that we consider this "separate power drop" as a separate metered service to a ½ - 1 horse power pump at each residential septic tank. Obviously, nearly all residential customers in your service territory and within the Los Osos Sewer District are currently serviced by a single meter. We have been asked to evaluate the feasibility of adding an electric meter at each single family residence, and possibly at multi-family residential properties as well. We are focusing primarily on the single family dwelling. We are attempting to create a cost model for the most likely conditions to be found at most residences in Los Osos. We will then prepare a cost associated with each model, and the County will quantify the number of each prototype in order to determine a final total cost. We are ignoring non-residential facilities and multi-family residential for purposes of this phase of the evaluation. There are numerous options that we are to consider on the customer side of the meter, but there are two likely scenarios for us to consider relative to your work on adding the metering on a single family residence. The first would be a single overhead service drop to a weatherhead from a joint pole or a service pole that is owned by PG&E and/or the other utilities to the residence. The second would be an underground conduit feed to an

*3562 Empleo, Ste.C - P.O.Box 1167*
*San Luis Obispo, California 93406*
*(805) 543-3850 FAX (805) 543-3829*
*E-mail – bthoma@thomaelec.com*

underground meter and main with distribution equipment on the residence. The overhead option is the most common condition in the Los Osos area, as very few homes have been built in over 20 years, and most services prior to the 1970's were likely to be overhead (this is a generalization, but somewhat correct throughout, we believe). The County will try to quantify how many of what type service exists, and we are not asking for your help on that matter. The overhead option could also be from either a rear property line pole location to the meter, or it could be from a front property (street side) pole location. In either case, we are seeing the same solution being applicable for adding a second meter. In the case of an underground service, the service is likely to be entering the property from the street side of the residence.

We have prepared a few simple exhibits for your review and comment relative to feasibility under PG&E's existing PUC rules for adding a second meter, keeping in mind that a superior agency (the State of California) is dictating the requirement for a separate meter.

In the case of the overhead service to a meter, we are suggesting that a completely separate meter and main (sized for only the pump which is ½ - 1 horse power) be mounted adjacent to the existing meter so that they are ganged for meter reading and that the risers be located within 36" of each other in order to allow PG&E to "jumper" the risers together. We have done this many times (up to 3 riser is allowed) in commercial applications. What I am not sure about, is if this capability also exists for residential services. All metering, risers, grounding would be completed by contractors, just like all other new business customers.

In the case of the underground service to a meter, we are suggesting that a new PG&E approved multi-meter switchgear be mounted on the residence (space may make this option very difficult in some situations we know). One meter would back feed to the existing subpanel and be sized the same as the existing meter, and a second meter, again, with a main circuit breaker, sized only for the septic tank pump motor and starter. The retrofit of the existing meter would blank the old meter off and it would be "back fed" (by a contractor) into the meter, or back into a subpanel/distribution panel either on the outside of the residence or inside which ever becomes easier. We have detailed a solution to this "cutover" by showing a new PG&E pull box placed over the existing service lateral. A new conduit from this box would then be routed into a new two meter, multi-meter surface mounted switchgear. Upon cutover to the new meters, the service wire into the original single meter section would be removed, and it would be either re-pulled into the new two meter section, or spliced in the box and extended into the new two meter section.

We have prepared a couple of very simplistic depictions of the concepts that have been discussed with the County of SLO and will ultimately be communicated to the State. They are attached and labeled Exhibit A to this letter. A rough elevation has been prepared for both options, however, an additional isometric detail relative to the underground option has been prepared to be clear of our intention. We hope these exhibits support the concept for you, relative to our request.

There are over 4,400 residences in the Los Osos area that could be affected by this concept. Each residence would have between a ½ horse power and a 1 horse power submersible septic tank pump installed. Each pump is expected to run approximately 20-30 minutes per day average or 10-15 hours per month. We must prepare our report with cost models to the State within 30 days. Our work will take at least 15 days to prepare, once we know the concepts are feasible under the rules, allowed by PG&E or not. If not, we must report to the state why they would not be allowed. Any superior option to those presented to you in this letter are welcomed and will be considered by us. We are asking for your response to this request for information within two weeks for the following information:

1. Feasibility of the presented options.
2. Alternative options we should consider (and still provide two meters to each residence).
3. Let us know if you have any concerns about service capacity (again, only running 10-15 hours per month and a maximum of 1 horse power per house).
4. PG&E ballpark estimated costs for each option for inclusion in our cost model in today's dollars. This should include all application fees, inspection fees, rearrangement costs, connection and disconnection fees.

If you feel this is not possible to complete, please give me a written notice of when you think you might be able to provide requested information to include. We are not planning on making an application at this time, however, if there are engineering costs for you to respond to this request, please forward that request to us immediately for processing.

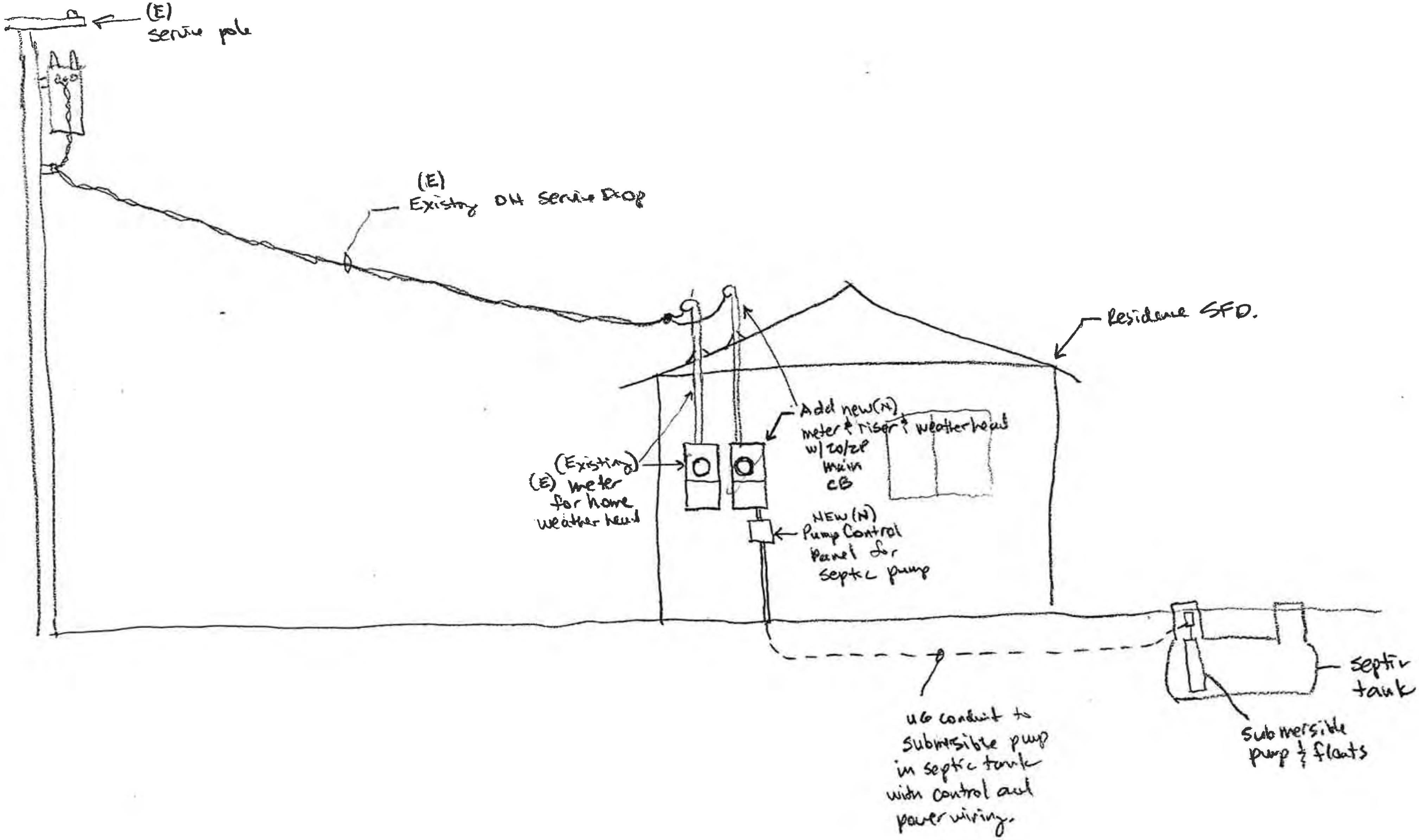
We certainly know you are extremely busy with many important current projects and yet we all know the urgency of the sewer issue in Los Osos. Please feel free to call me to set up a meeting if you need to review this matter in person, or have questions answered before you proceed. Thank you in advance for your, as always, great work and coordination in serving our mutual customers in Los Osos.

Sincerely,

William A. Thoma, P.E.
Thoma Electric, Inc.
K:\ENG\2007\07-8046\CORRESP\07-8046_Study to Evaluate Feasibility_2007-4-5.DOC

Cc: Rob Miller
John Waddell

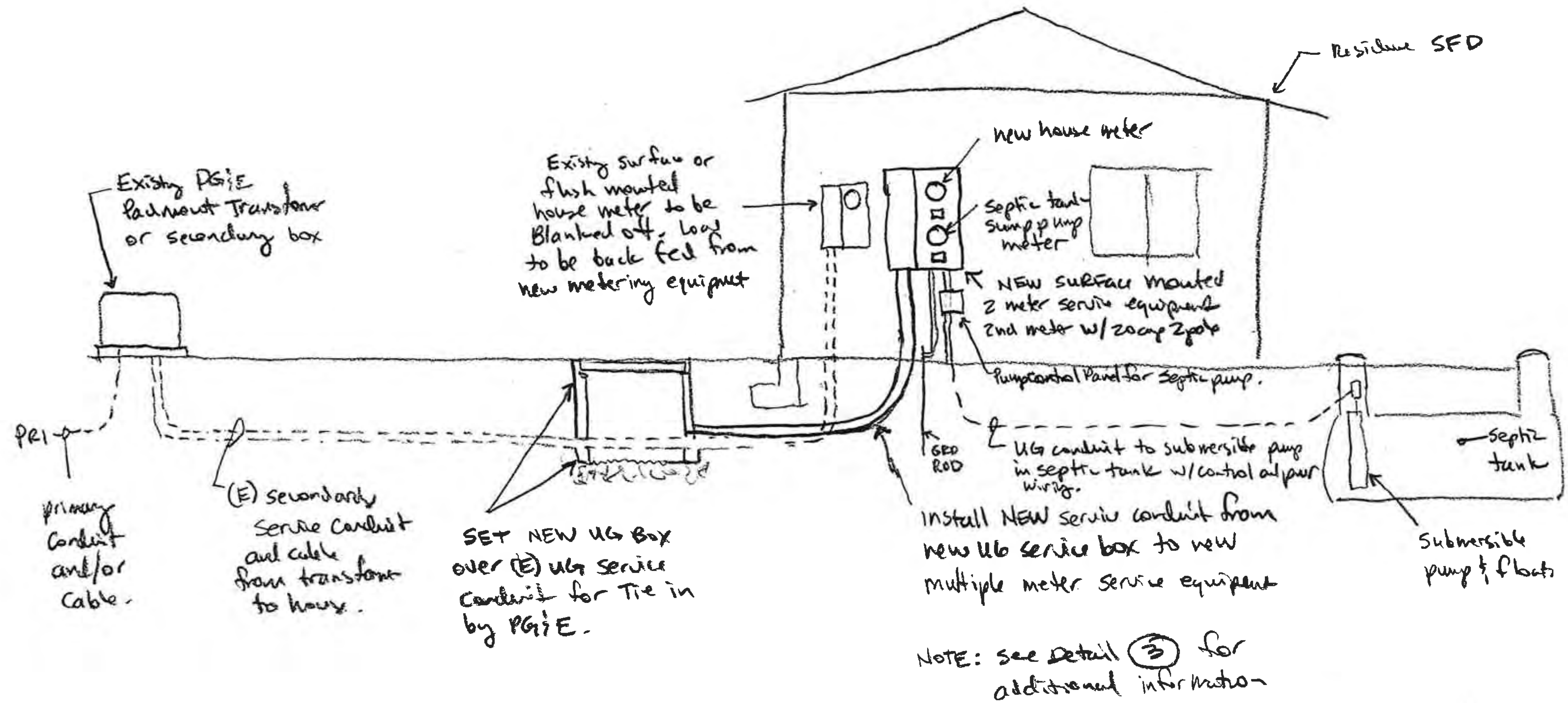
# EXHIBIT A




① OVERHEAD SERVICE OPTION

NTS. ADDING SECOND METER

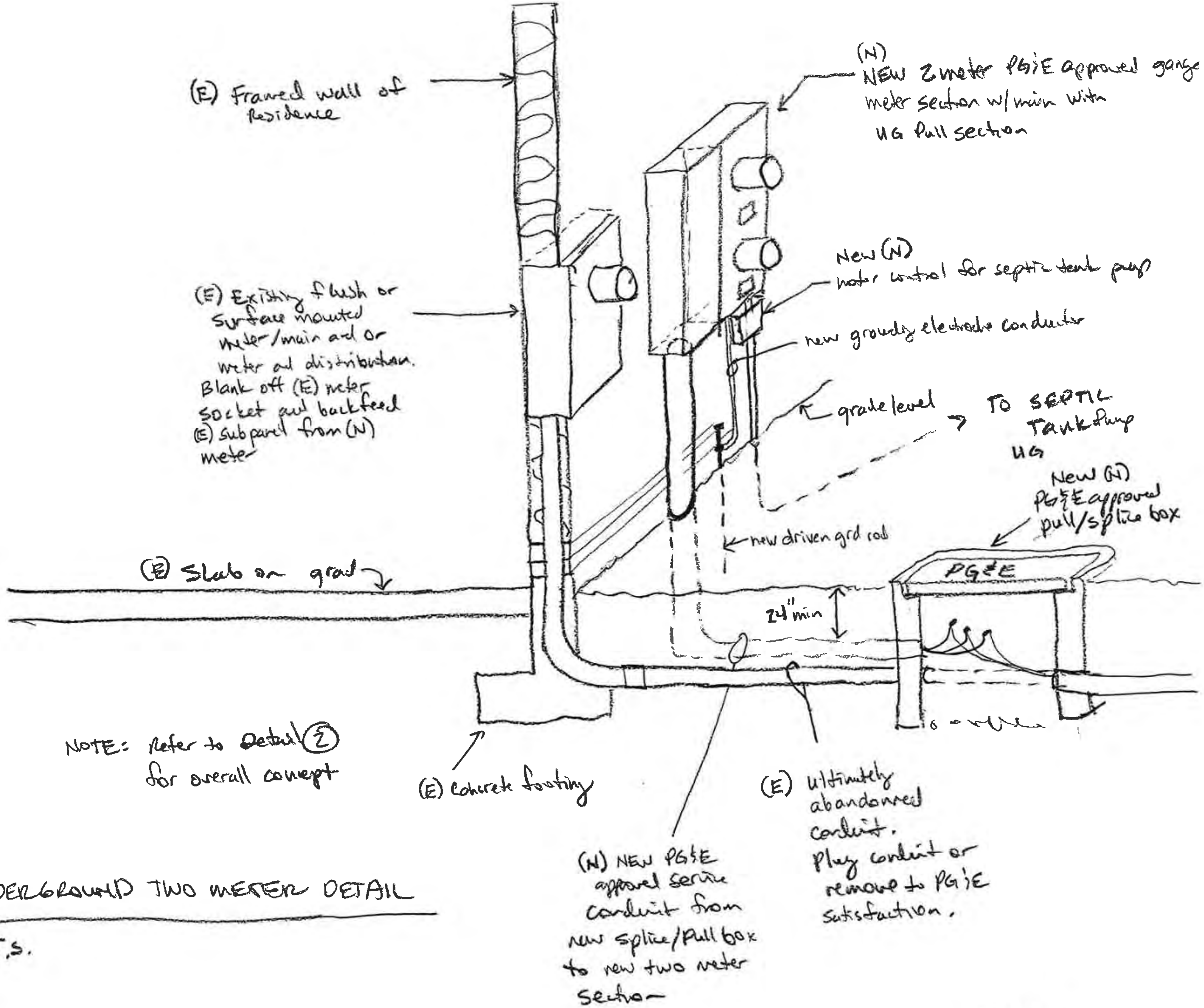
W A Thomas
4/5/07




2 UNDERGROUND SERVICE OPTION

NTS. ADDING SECOND METER

WATHOMA
4/5/07




3 UNDERGROUND TWO METER DETAIL

N.T.S.

WA. THOMA
4/5/07

**From:** "Burke, Robert" <RMBe@pge.com>
**To:** "bill thoma" <bthoma@thomaelec.com>
**Date:** 4/27/07 1:56PM
**Subject:** RE: Los Osos CSD STEP system

Bill:

Follow up from my vmail.

Overhead addition $750-$1000
Underground re-arrangement $3000-$4000.

Call me if you want.

Bob

-----Original Message-----
From: bill thoma [mailto:bthoma@thomaelec.com]
Sent: Thursday, April 26, 2007 4:24 PM
To: Burke, Robert
Subject: Los Osos CSD STEP system

Bob, Hoping you have a chance to get me that information before the end of the day tommorrow??? I would like to have a chance to put it together over the weekend for them for the middle of next week. I am just needing a green light as to the concepts (which you already gave me verbally) and a cost for each senario if you can. I will do my best to make sure they know it is all very concepual and not to rely on the costs until they get a little furthter down the road. Thanks, Bill

--


--
This message has been scanned for viruses and dangerous content by MailScanner, and is believed to be clean.

# APPENDIX B

Condition of Variations for Cost

## Overhead Service

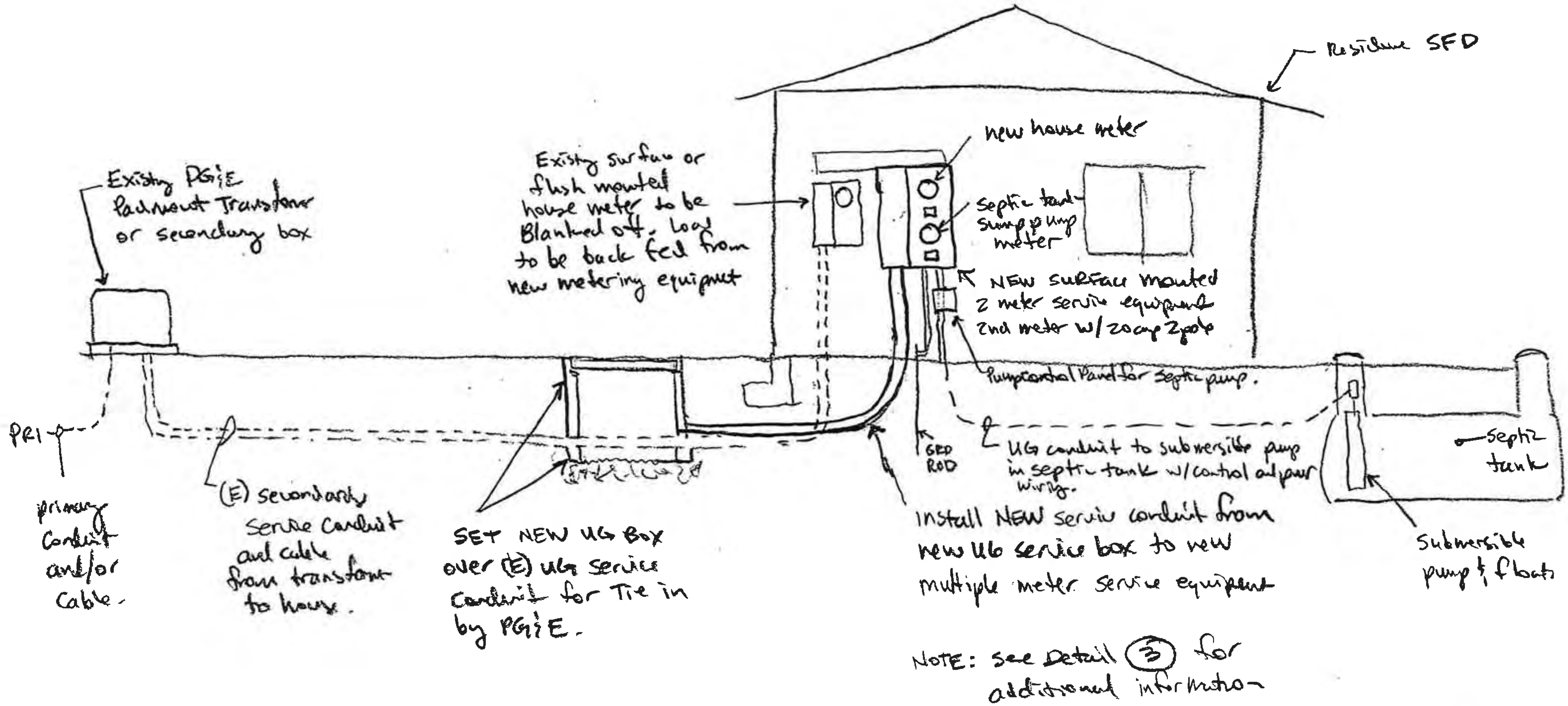
- Not room on existing residence to mount metering equipment? (i.e., windows, doors, planters).
- Penetrations through roofing can be difficult depending on roof condition.
- Panel will be surface mounted; +/- 5" protrusion in addition to meter from wall.
- Is there code required 36" of clearance in front and 30" clearance side to side for meter? (Per CEC).
- Is landscaping needing to be trimmed back?
- Can $2^{nd}$ meter be mounted within 18" of existing riser?
- If rear property OH service, how much difficulty getting to front yard STEP tank (i.e., landscaping, hardscape, fences, retaining walls).
- Footings protrude beyond face of wall (below grade) preventing UG conduit to tank from being right next to wall as well as ground rod.
- Aesthetics issues have not been considered.

# APPENDIX B

Condition of Variations for Cost

## Underground

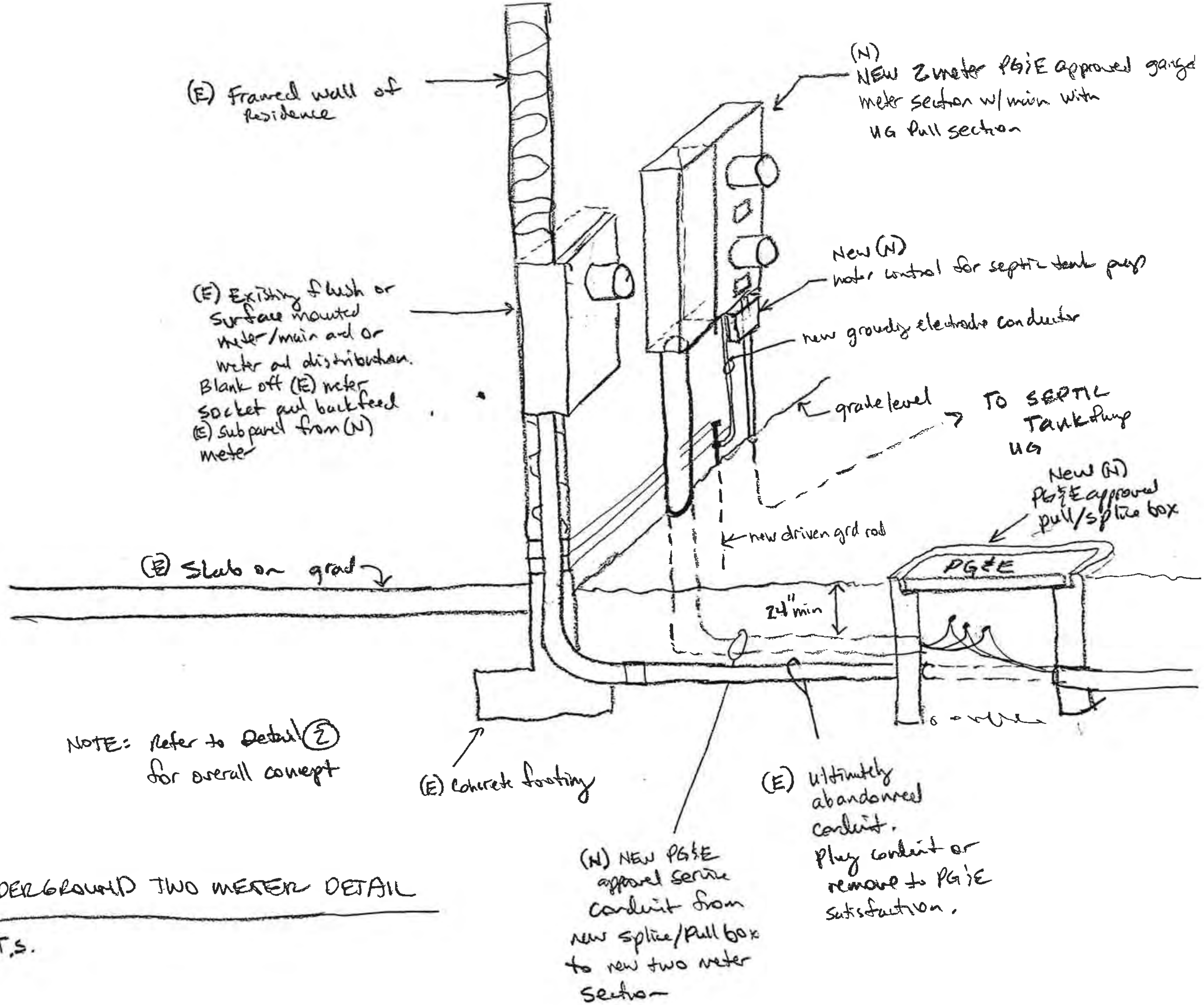
- Not room on existing residence to mount metering equipment. The meter for two sockets is much larger than existing meter socket.
- UG conduit may travel under driveway, sidewalk, thru landscape, under retaining wall. Location of UG box may be impossible without major disruption to site.
- Panel will be surface mount and be 6-8" protrusion in addition to meter.
- Is there 36" of clearance in front of and 30" clearance side to side for meter? (Per CEC).
- Is landscaping needing to be trimmed back?
- Every existing meter panel and distribution arrangement will be different. Some will have "all in one" main and distribution, others will be meter main only feeding to a subpanel inside the residence. The back feed will involve patching siding if existing meter is flush.
- Existing flush meters will remain blanked off (aesthetic issue).
- Aesthetics issues have not been considered.
- Finding a suitable location for an U.G. pull box to intercept PG&E service may be difficult and may need to be a traffic rated box.
- Other utilities such as telephone and CATV may be in same trench with PG&E adding to complexity of segregation and interception of PG&E conduit.
- Tank is on opposite side of driveway from where meter is located crossing driveway.
- Some driveways may not be simple grey concrete; could be tile, brick, stamped, pavers, colored concrete, asphalt.




(2) UNDERGROUND SERVICE OPTION

NTS. ADDING SECOND METER

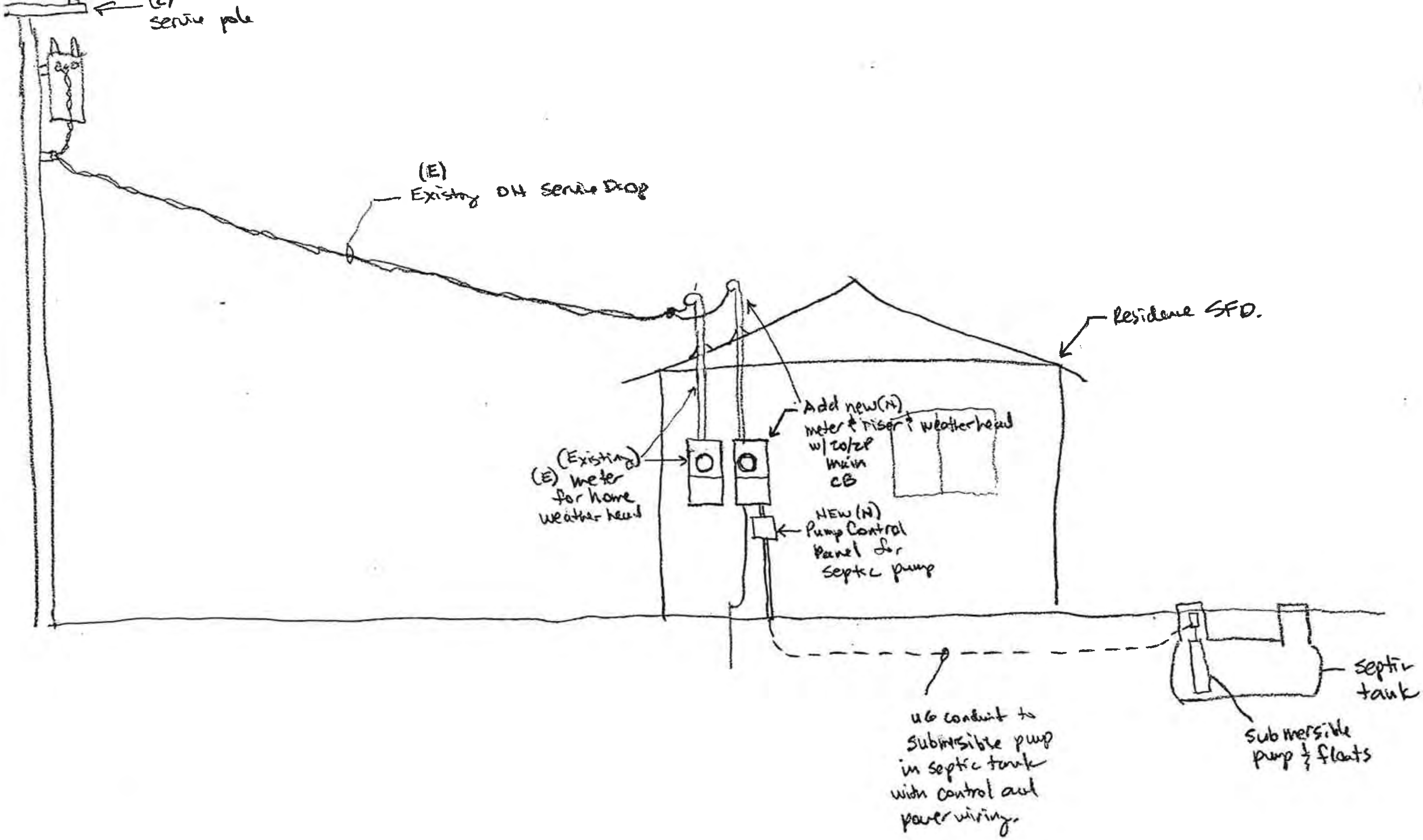
WATHOMA
4/5/07




③ UNDERGROUND TWO METER DETAIL

N.T.S.

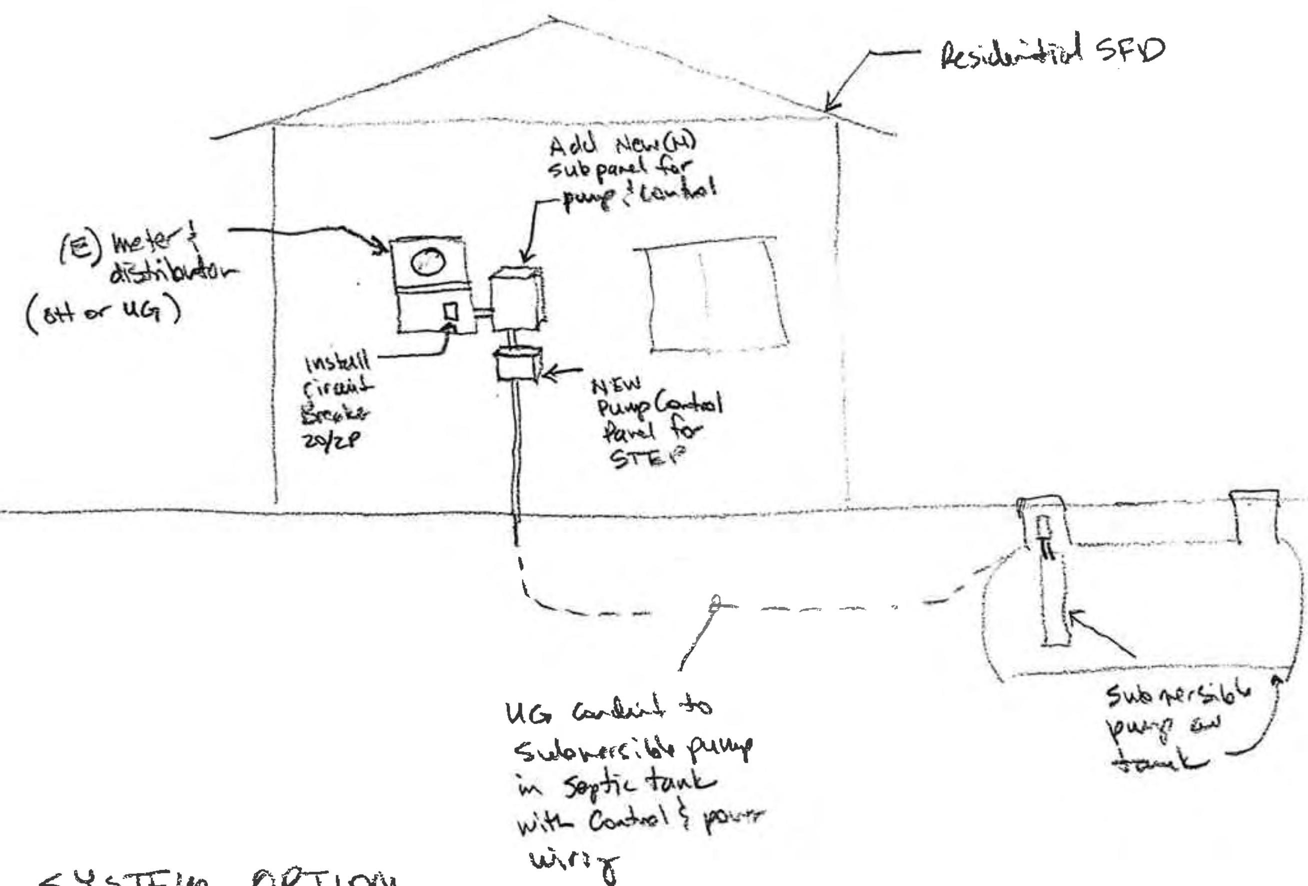
W.A. Thoma
4/5/07




1 OVERHEAD SERVICE OPTION

NTS. ADDING SECOND METER

WA THOMAS
4/5/07




4 TIE INTO EXITING SYSTEM OPTION

NTS. ADDING SUBPANEL

WATHOW
4/5/07

APPENDIX C
STATEMENT OF PROBABLE CONSTRUCTION
COST WORKSHEET
MATRIX

| | | | Per Unit $ | $ Total/ Residence |
|---|---|---|---|---|
| | | | | |
| Must pick one box in this range | ☐ | Condition #1 – Add Overhead Meter to Existing Residence | $2,960 | |
| | ☐ | Condition #2 – Add Meter to Existing UG Service Where Service is 100 amp | $10,275 | |
| | ☐ | Condition #3 – Add Meter to Existing UG Service Where Service is 200 amp | $10,700 | |
| | ☐ | Condition #4 – Add Subpanel and Distribution to Existing Service | $1,050 | |
| | | | | |
| Must pick one box in this range | ☐ | Distance From House to STEP Tank 20' @28.75/LF | $575 | |
| | ☐ | Distance From House to STEP Tank 40' @28.75/LF | $1,150 | |
| | ☐ | Distance From House to STEP Tank 60' @28.75/LF | $1,725 | |
| | ☐ | Distance From House to STEP Tank 80' @28.75/LF | $2,300 | |
| | ☐ | Distance From House to STEP Tank 100' @28.75/LF | $2,875 | |
| | | | | |
| As Applicable | ☐ | Driveway Crossing One at a Time | $2,500 each | |
| | ☐ | Driveway Crossing 4-5 per day (most efficient for Boring Contractor) | $500 each | |
| | | | | |

# APPENDIX C
# STATEMENT OF PROBABLE CONSTRUCTION COST WORKSHEET MATRIX

| | | | Per Unit $ | $ Total/ Residence |
|---|---|---|---|---|
| | | | | |
| | | Appendix B Factors | | |
| ______ | | | Very Rough Budgets | |
| As Applicable on a Property by Property Basis | ☐ | Landscape Issues | $500 | |
| | ☐ | Hardscape, Retaining Walls, Fences, Clearance Issues | $1,000 to $5,000 | |
| | ☐ | Space for New Metering Equipment | $3,000 | |
| | ☐ | Difficult Roofing Situations for OH Riser | $1,000 | |
| | ☐ | Service Must be Upgraded to Accommodate Load | $2,000 to $10,000 | |
| | ☐ | Difficulty in Locating New UG Vault on Site | $500 to $5,000 | |
| ______ | | | | |

Note: See Exclusions and Qualifications Next Page

# APPENDIX C
# STATEMENT OF PROBABLE CONSTRUCTION COST WORKSHEET MATRIX

These Statements of Costs
DO NOT INCLUDE
Exclusions and Qualifications

1. Special paving requirements for replacement.
2. Traffic rated underground box lids.
3. Replacement of landscaping, fences, walls, sidewalk, driveway.
4. Pruning of vegetation.
5. Painting to match existing wall colors.
6. Structural modification work to accommodate panels.
7. Remedy for pre-existing, non-code conforming violations.
8. Furnishing of pump or pump control panel for STEP (labor is included to connect).
9. Furnishing pump or tank
10. Providing standby, emergency back-up power.
11. Cost of County permits and processing.
12. Escalation of labor and material costs beyond current date of 5/1/07.
13. Cost impacts to other utilities that could be affected by work required herein.

OVERALL BUDGET STATEMENT OF PROBABLE CONSTRUCTION COST
(ONE POSSIBLE SCENARIO)

| | | | Quantity of Residence | $ Per Unit | Total $ |
|---|---|---|---|---|---|
| | Assume 4,400 Residences | | | | |
| | | | | | |
| | 80% OH Service Condition 1 Average 80' | | 3,520 | 4,685.00 | 16,491,200 |
| | 10% UG Service 100 Amp Condition 2 Average 80' | | 440 | 12,000 | 5,280,000 |
| | 10% UG Service 200 Amp Condition 3 Average 80' | | 440 | 12,425 | 5,467,000 |
| | 50% of all Must Cross Driveway | | 2,200 | 2,500 | 5,500,000 |
| | If in Quantity | | | 500 | 4,400,000 |
| | | | | | |
| | Appendix B Issues | | | | |
| 1. | Landscape 50% | 50% | 2,200 | 500 | 1,100,000 |
| 2. | Hardscape, Retain | 25% | 1,100 | 2,500 Average | 2,750,000 |
| 3. | Space for Metering | 25% | 1,100 | 3,000 | 3,300,000 |
| 4. | Difficult Roofing Situation | 25% | 1,100 | 1,800 | 1,100,000 |
| 5. | Service Upgrade | 5% | 220 | 5,000 Average | 1,100,000 |
| 6. | Difficulty in Locating New UG Vault | 15% | 660 | 2,500 | 1,650,000 |
| | | | | | |
| | | | | | $43,738,200 |
| | | | | | (4,400,000) Boring in Quantity |
| | | | | | |
| | Compare to Condition #4 | | 4,400 | 3,350 | 14,740,000 |
| | 50% Driveway Crossing | | 2,200 | 2,500 | 5,500,000 |
| | Appendix B Issues That Apply (1, 2, 5) only | | | | 4,950,000 |
| | | | | | |
| | | | | | $25,200,000 |
| | | | | | |

NOTE: Cost Exclusions Do Not Apply Cost Based On Assumptions

Appendix C

# BASIS OF COST EVALUATION TECHNICAL MEMORANDUM

# BASIS OF COST EVALUATION

## 1.1. INTRODUCTION

The cost estimates for the Los Osos Wastewater Project Development will be developed primarily to serve three purposes: 1) to compare costs among alternatives; 2) as a basis for the assessment engineering effort and 3) as a basis for funding strategies and opportunities. This project memorandum provides procedures and guidelines for estimating capital and operation and maintenance (O&M) costs for the Los Osos Wastewater Project Development. These capital and O&M costs will be the basis for developing total annualized costs.

The level of accuracy that can be expected is directly proportional to the level of engineering effort completed. Each cost estimate must be carefully prepared from the conceptual level to the facilities plan level, through the preliminary design and the final engineer's estimate. At this conceptual planning phase of the wastewater Project Development, different levels of cost estimates are appropriate for different project components.

## 1.2. SCOPE AND LEVEL OF ACCURACY

The Association for the Advancement of Cost Engineering International (AACE International, formally known as the American Association of Cost Engineers) has suggested levels of accuracy for five estimate classes. These five estimate classes are presented in the AACE International Recommended Practice No. 18R-97.

Table 1.1 presents a summary of these five estimate classes and their characteristics including expected accuracy ranges.

The quantity and quality of information required to prepare an estimate depends on the end use for that estimate. Typically, as a project progresses from the conceptual phase to the study phase, preliminary design and final design, the quantity and quality of information increases, thereby providing data for development of a progressively more accurate cost estimate. A contingency is often used to compensate for lack of detailed engineering data, oversights, anticipated changes and imperfections in the estimating methods used. As the quantity and quality of data improve, smaller contingency allowances are typically utilized. Because detailed design information is available for the gravity collection system, but not other project components, different levels of estimates will be provided for different project components at this planning phase, as outlined in Table 1.2.

For most of the components of the projects developed as a part of the Los Osos Wastewater Project Development, cost estimates are developed following the AACE International Recommended Practice No. 18R-97 estimate Class 4. Class 4 budget estimates are prepared with limited design information. Costs are developed using equipment factors, parametric models, engineering judgment or analogy (reference to past projects).

Class 4 estimates are prepared for any number of strategic business planning purposes including, but not limited to, detailed strategic planning, confirmation of economic and/or technical feasibility, and preliminary budget approval or approval to proceed to next stage. Limited information is available at the time when a Class 4 estimate is developed. Therefore, Class 4 estimates virtually always use stochastic estimating methods such as parametric or other modeling techniques, and various factors. Subsequently, estimated costs have wide accuracy ranges. Typical accuracy ranges for Class 4 estimates are minus15 to 30 percent on the low side, and plus 20 to 50 percent on the high side, depending on the technological complexity of the project, availability and accuracy of appropriate reference information, and the inclusion of an appropriate contingency determination. Modifications typically occur during design of a project including changes that may have occurred to the project scope, existing facilities, and other assumptions on which the project is based.

**Table 1.1 Category of Cost Estimates[1]**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| | Primary Characteristic | Secondary Characteristic | | | |
|---|---|---|---|---|---|
| **ESTIMATE CLASS** | **LEVEL OF PROJECT DEFINITION** Expressed as % of complete definition | **END USAGE** | **METHODOLGY** Typical estimating method | **EXPECTED ACCURACY RANGE** Typical variation in low and high ranges (a) | **PREPERATION EFFORT** Typical degree of effort relative to least cost index of 1 (b) |
| **Class 5** | 0% to 2% | Concept Screening | Capacity Factored, Parametric Models, Judgment, or Analogy | L: -20% to –50%<br>H: +30% - +100% | 1 |
| **Class 4[2]** | 1% to 15% | Concept Screening or Feasibility | Capacity Factored, Equipment Factored, Parametric Models or Analogy | L: - 15% to -30%<br>H: +20% - +50% | 2 to 4 |
| **Class 3** | 10% to 40% | Budget, Authorization, or Control | Semi-Detailed Unit Costs with Assembly Level Line Items | L: - 10% to -20%<br>H: +10% - +30% | 3 to 10 |
| **Class 2** | 30% to 70% | Control or Bid/ Tender | Detailed Unit Cost with Forced Detailed Take-Off | L: - 5% to –15%<br>H: +5% - +20% | 4 to 20 |
| **Class 1** | 50% to 100% | Check Estimate or Bid/Tender | Detailed Unit Cost with Detailed Take-Off | L: - 3% to –10%<br>H: +3% - +15% | 5 to 100 |

Notes:
1. Table 1.1 comes from the AACE International Recommended Practices and Standards, No. 18R-97.
2. Most of the estimates in the Fine Screening Report are at this level.
   a. The state of process technology and availability of applicable reference cost data affect the range markedly. The +/- value represents typical percentage variation of actual costs from the cost estimate after application of contingency (typically at a 50% level of confidence) for a give scope.
   b. If the range index value of “1” represents 0.005% of project costs, then an index value of 100 represents 0.5%. Estimate preparation effort is highly dependent upon the size of the project and the quality of estimating data and tools.

| Table 1.2 Class of Estimate for Project Components<br>Los Osos Wastewater Project Development<br>San Luis Obispo County | |
|---|---|
| **Project Component** | **Cost Estimate Class** |
| Gravity Collection System | 1 or 4 |
| For example: | |
| • Conveyance Piping | 1 |
| • On-Lot Laterals | 4 |
| STEP Collection System | 4 |
| Treatment Plant | 4 |
| Solids Treatment and Disposal | 4 |
| Effluent Reuse/Disposal | 4 |

Since a gravity collection system has already been designed for Los Osos, Class 1 estimates are available for this component. Class 1 estimates are prepared from very well-defined engineering data. For this class of estimate, the expected accuracy range is within +15 percent to –10 percent. This means that bids can be expected to fall within a range of 15 percent over the estimate to 10 percent under the estimate. The Class 1 estimate is based, at a minimum, on complete site plans, single-line electrical diagrams, process and instrumentation diagrams, equipment data sheets and quotations, structural plans and cross-sections, and detailed drawings of structures and equipment assemblies, building cross-sections and elevations, and a complete set of specifications. The estimates incorporate detailed unit costing with a detailed quantity take-off. Design completion level of the Class 1 estimates fall within 50 percent to 100 percent complete.

## 1.3. BASIS OF COST EVALUATIONS

The costs presented for the Los Osos Wastewater Project Development will be based on preliminary layouts, preliminary unit process sizes and conceptual alternative configurations. Construction costs will be estimated from unit costs developed from estimating guides, equipment manufacturers information, unit prices, and construction costs of similar facilities and configurations at other locations. O&M costs will based on operating costs at other similar facilities and local cost data. A summary of the economic criteria to be used for estimating costs is presented in Table 1.3.

| **Table 1.3 Economic Criteria<br>Los Osos Wastewater Project Development<br>San Luis Obispo County** | |
|---|---|
| Item | Assumption |
| Costs in Time and Place | Costs are based on June 2011(mid-point of construction) costs in San Luis Obispo, California |
| Escalation in Cost Index | The cost escalation for June 2011 (mid-point of construction) is assumed at 5 percent, compounded annually. |
| Construction Contingency | 30 percent (Class 4); 10 percent (Class 1) - unless stated otherwise |
| Project Cost Factor | A line item will be provided that includes the following:<br>• Design engineering<br>• Construction management/adjustments<br>• Administration & legal (design staff support, construction management staff support, internal legal and administrative costs.) |
| Environmental Documentation, Mitigation & Permitting | • $1-3M depending on project selected, plus land restoration costs of $20,000 to $50,000 per acre |
| Land Acquisition | • $30,000 per acre for non-prime agricultural land, (capped at $7,000,000 - the cost for a 600 acre parcel of land east of Los Osos that is on the market)<br>• $40,000 per acre for prime agricultural land<br>• $30,000-50,000 per acre for first tier treatment plant sites |
| Sales Tax | • 8% of material costs |

### 1.3.1. Construction Costs

The basis for estimating construction costs is presented in Table 1.4.

While the estimated construction costs represent the average bidding conditions for many projects, variations in bidding climate at the time the facilities are constructed can affect actual construction costs. Further, the size of the facilities may be refined during preliminary design based on the most current operational information available. For these reasons, the actual construction costs may be lower or higher than originally estimated.

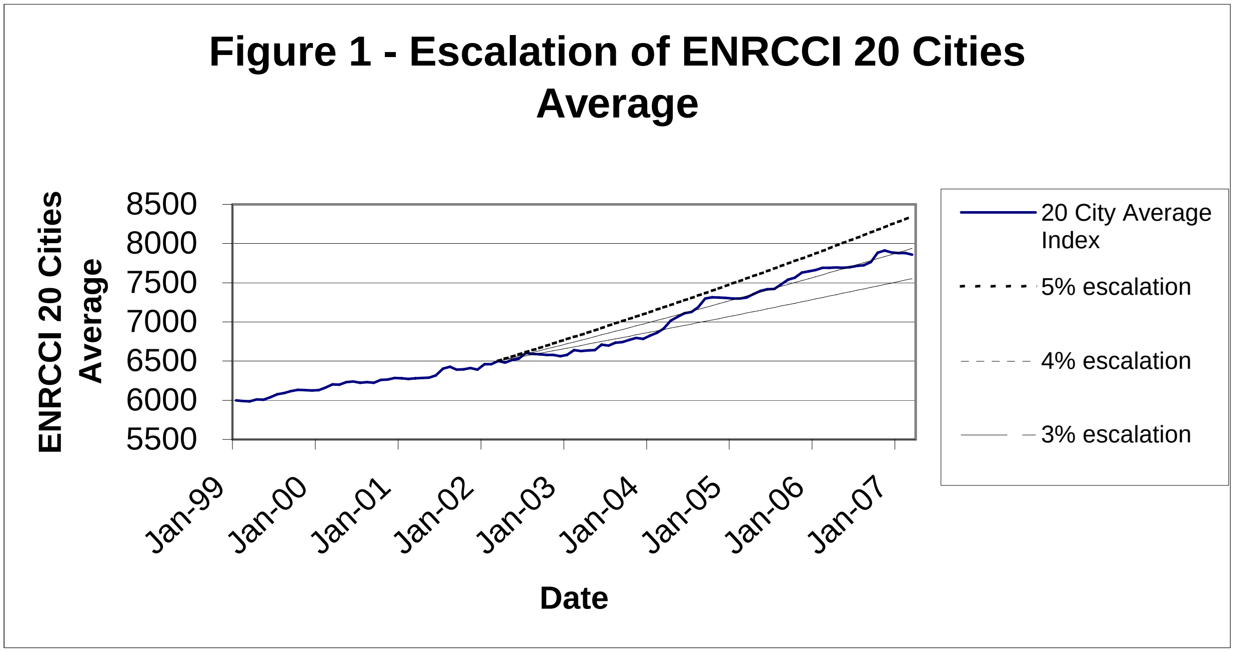
Construction costs have historically escalated with time. This trend is expected to continue in the future. To record these trends in rising costs, several indices have been established for various fields of construction. One commonly used indicator of changes in heavy construction prices is the Engineering News Record (ENR) Construction Cost Index (CCI).

| Table 1.4 Basis for Estimating Project Costs<br>Los Osos Wastewater Project Development<br>San Luis Obispo County | |
|---|---|
| Item | Estimated Cost(1) |
| Obtain Base Construction Cost from Bid Tabs, previous Engineers Estimates, analogous facility costs, parametric models and/or Carollo's unit price catalog. Adjust this cost to April 2007 cost for San Luis Obispo, California. Cost includes:<br>• Adjustment to "mid range" of bids for each item<br>• Mobilization/Demobilization<br>• Electrical<br>• Site Work/Yard Piping<br>• Sales Tax on materials only (8%)<br>• Contractor overhead and profit (15%) | **"A"** |
| Add 30% of Subtotal Cost to Class 4 estimates and 10% to Class 1 estimates as Construction Cost Contingency. | + 10% to 30% of "A" |
| **Subtotal Estimated Construction Cost** | **"B"** |
| Add 8% sales tax on materials and 15% for contractor overhead and profit | + 15% to 22% of "B" |
| **Subtotal Estimated Construction Cost** | "**C**" |
| Escalate to June 2011 - 5% per year | + 24.5% of "C" |
| **Subtotal Escalated Estimated Construction Cost** | **"D"** |
| Project Cost - will provide line items (2) | +"E" |
| **Total Estimated Project Cost** | **"F"** |

Notes:
1. Based on June 2011 costs for San Luis Obispo, California (Estimated ENRCCI projection for the 20-Cities Average is 7879 for February 2007 and location factor adjustment is 1.054.).
2. Includes design engineering contingencies, construction management, administrative, and legal costs.

ENR develops and publishes ENRCCIs for 20 cities in the U.S. and 2 in Canada. San Luis Obispo is not one of the cities tracked by the ENR. Therefore, the ENRCCI for the U.S. 20 Cities average will be used to establish the ENRCCI for the San Luis Obispo cost estimate. A location factor of 1.054 from R.S. Means will be used to adjust construction costs between the 20 Cities average and San Luis Obispo.

Construction costs for the Los Osos Wastewater Project Development will be based on June 2011 costs for San Luis Obispo, California. This date is projected as the mid-point of construction. To calculate this mid-point of construction cost, costs will first be prepared as February 2007 costs. Then, an estimated escalation rate from February 2007 to June 2011 will be applied to project the June 2011 construction costs. The estimated average escalation rate for the past 5 years has been approximately 4 percent per year based on the escalation of the U.S. 20 Cities average ENRCCI for 2001 to 2006 (Figure 1). However, there have been periods of much higher escalation. For example, escalation was approximately 7 percent in 2004. An escalation factor of 5 percent per year will be used in the estimates for this project to account for potential surges in escalation. This results in a total escalation of 24.5 percent from February 2007 to June 2011.




The total construction costs presented in Table 1.4 include construction contingencies. Construction contingencies cover costs that result from a change in scope, uncertainties in conditions or incomplete design information at the time of the estimates.

A project cost will be added to the total construction costs to arrive at the total estimated project cost. Costs to the owner, such as engineering, legal, administrative, project contingencies, and construction management costs will be added to the construction costs.

### 1.3.2. Local Bidding Market

The estimates of construction costs do not account for all of the factors associated with the bidding market. When the previous TriW Project went out to bid, the project was controversial. Additionally, there was and continues to be a large number of infrastructure projects being built in the State of California. Therefore, contractors have a lot of flexibility to bid on projects that entail a low risk. Additionally, due to the lack of competition, contractors who do bid on high-risk projects can bid higher amounts to account for the risk. It was estimated by Montgomery Watson Harza that the lack of bid competition led to 20 percent to 30 percent higher bids for the Tri-W Project Because this iteration of the Los Osos Wastewater Project will be developed by San Luis Obispo County, it may be perceived in the bidding market that some of the contractors' risk will be reduced. However, the contentious and litigious history of the project may lead to higher bids than comparable projects in other areas, since local factors are not reflected in the estimates. Therefore, it is incumbent upon the County and community to create a business-friendly condition for contractors in order to attract as many bidders as possible.

### 1.3.3. O&M Costs

O&M unit costs are presented in Table 1.5. These unit costs represent the estimated 2007 unit costs. The unit costs presented will be used in developing O&M costs for each alternative. The O&M costs include labor, energy and chemicals.

**Table 1.5 O&M Unit Costs**
**Los Osos Wastewater Project Development**
**San Luis Obispo County**

| Item | Cost[(1)] |
|---|---|
| •Labor (Includes workers compensation insurance and other labor-related costs) | $60/hour - plant operator average<br>$40/hour - unskilled labor average |
| •Energy | $0.12 per kilowatt-hour |
| **Chemicals** | |
| Chlorine (12.5%) | $0.96/gallon |
| Sodium Bisulfite | $0.79/gallon |
| Sodium hydroxide (50%) | $0.24/lb |
| Ferric Chloride | $360/dry ton |
| A210P Polymer (Anionic) | $0.95/dry lb |
| C6264 Polymer (Cationic) | $1.18/dry lb |
| Methanol | $3.00/gallon |

Notes:
1. Based on estimates provided by the County operations records for other facilities, unless otherwise noted.