RIPLEY PACIFIC COMPANY
WATER REUSE INFRASTRUCTURE

June 29, 2011
Via U.S. Mail and email: Jonathan.adelstein@usda.gov

Jonathan Adelstein, Administrator
Rural Utilities Service
United States Department of Agriculture
1400 Independence Ave, S.W.
Washington D.C. 20250-0700

Re: $200 million Los Osos, San Luis Obispo County, CA Wastewater Project
Seismic Hazard Mitigation

Mr. Adelstein:

This letter report is submitted to you in response to your February 3, 2011 letter[1] to Oregon Congressman Peter DeFazio regarding Rural Development (RD) Rural Utilities Service (RUS) funding of $86 million towards the implementation of the $200 million Los Osos Wastewater Project located in San Luis Obispo County, CA. In particular, this report focuses on RD design policies prescribed in CFR § 1780.57(n)(o) as related to cost and seismic safety.

Your February 3 letter was obtained by this office from a Los Osos ratepayer via a FOIA telephone request dated March 9, 2011 and transmitted to the ratepayer under RD cover letter dated April 21, 2011.

Ripley Pacific Company is an independent water, wastewater, and water reuse consultancy with two decades of experience planning and entitlements associated with master planned communities, resorts, and small community septic abatement projects. I personally have three decades experience in the water/wastewater profession and am a licensed civil engineer in the State of California.

Statement of Purpose
The purpose of this report is to bring to the attention of RD certain elements of San Luis Obispo County's (applicant) Preliminary Engineering Report (PER) that are considered by this office to be either misrepresented or omitted entirely. These items include system life cycle cost analysis and adequate mitigation for known seismic hazards. In addition, there is a significant body of new information related to seismically-induced liquefaction resulting from the March 11, 2001 M9.0 Greater Tohoku, Japan earthquake and the South Island, New Zealand September 3, 2010 M7.0 earthquake followed by M6.3 and M6.0 aftershocks[2] dated February 21, 2011 and June 13, 2011, respectively.

[1] See Exhibit A.
[2] See Exhibit B.

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The focus herein is to direct RUS attention to both submitted information in the PER (including the project's environmental documentation) as well as new information related to these recent seismic events. While there are a number of other technical issues of concern related to the PER, this letter report will focus narrowly on CFR § 1780.57 Paragraphs (n) and (o).

2006 Los Osos Community Services District Wastewater Plan

In the spring of 2006, Ripley Pacific Company was awarded by competitive RFP process an assignment to develop a comprehensive wastewater collection, treatment, and water reuse plan (Ripley Plan) for the Los Osos Community Services District (LOCSD). A draft plan was presented to the community in August 2006 and that plan was peer reviewed by an independent panel of the National Water Research Institute (NWRI) in November 2006. Both the NWRI final report[3] and the Ripley Plan final report[4] were submitted to the LOCSD in December 2006. The NWRI panel fully validated all elements of the Ripley Plan in its final report.

The Ripley Plan included pressure effluent collection, a treatment site located east of town, seasonal effluent storage and 100% beneficial reuse of tertiary effluent for urban and ag reuse. Subsurface effluent dispersal was not included in the Plan due to dispersal capacity constraints and highly speculative benefits to either of the two productive aquifers in Los Osos. Gravity sewer collection was not considered an appropriate collection technology due to its higher life cycle costs (contrary to applicant's subsequent May 2010 PER) and more importantly its vulnerability to infiltration of saline groundwater. Infiltration of saline groundwater is a common problem in California coastal communities that reclaim wastewater since effluent salt levels can increase beyond limits tolerated by turf or crops.

Since 2006, it has become further evident that the gravity collection alternative is inappropriate for a water-stressed community where a high water conservation ethic along with mandated water conservation codes exist. The penetration of grey-water systems, now legal in California, will also reduce sewer hydraulic volumes. The resulting "blackwater" sewers will lack sufficient flushing volumes to scour pipe interiors as well as present a definite hydrogen sulfide corrosive risk to all concrete and metal surfaces. Deficient in adequate oxygen, blackwater sewers are notorious odor generators and there are now numerous instances of this condition in urban service areas with a high utilization of low and ultra-low flow water fixtures. Grey-water systems will only exacerbate this blackwater condition particularly in the summer months.

The pressure effluent system consisting of high-density polyethylene (HDPE) pipe has the benefit of being 100% sealed largely eliminating groundwater infiltration and release of odors. HDPE is also immune from hydrogen sulfide corrosion. For these reasons, HDPE pressure collection was included in the 2006 Ripley Plan as the preferred collection technology. An

[3] See Exhibit C.
[4] See Exhibit D (Executive Summary, full 300-page report pdf available on request).

extensive comparison of the two alternatives further indicated that it was also substantially lower in cost to build and operate[5].

In 2008, the applicant presented a wastewater plan to the San Luis Obispo County Planning Commission that included none of the elements of the Ripley Plan. Through extensive deliberations and a field trip by the Planning Commission, the treatment plant site selection and effluent reuse plans in the Ripley Plan were restored and ultimately included in the May 2010 PER submitted to RUS. Pressure effluent collection using HDPE sealed pipes was deemed a viable collection alternative in the screening and environmental review process, however was not included, as you indicate, as the selected alternative in the applicant's PER for *non-monetary factors* since *the estimated costs based on the level of uncertainty were essentially the same.* The applicant's selected alternative included in the May 2010 PER consists of conventional non-pressurized gravity sewer collection technology utilizing gasketed bell and spigot jointed polyvinyl chloride (PVC) pipe.

Los Osos Seismic/Liquefaction Hazard

Nearly the entire Los Osos collection area is rated "very high potential" for seismically-induced liquefaction. This mapping has been consistent in separate graphics prepared in 1999, 2005, 2007, and 2008 produced by the applicant[6]. The cumulative impact analysis for the four alternatives under consideration in the expanded geology analysis of the draft EIR summarizes this liquefaction risk as follows.

> *The proposed facilities that are part of the collection system and at the treatment plant site for Proposed Projects 1 through 4 may expose structures to liquefaction impacts. Therefore, implementation of Proposed Projects 1through 4 may contribute to cumulative liquefaction impacts within the vicinity of Los Osos. This contribution is considered cumulatively considerable and, therefore, significant for Proposed Projects 1 through 4.*[7]

It is abundantly clear that the liquefaction potential is a well-documented high risk geologic hazard in Los Osos as confirmed by the applicant's consistent liquefaction mapping and the applicant's declaration in the 2008 project environmental report that the liquefaction impact is *considerable and, therefore significant*.

Lessons Learned from 2011 Japan and New Zealand Earthquakes/Afterhocks

Since the March 2011 Greater Tohoku earthquake in Japan, worldwide attention has focused on the catastrophic impacts to life and property caused by severe earthquakes. Most of this attention has been focused on the earthquake itself, the resulting tsunami, and radiation released from damaged nuclear power plants located in Fukushima. What has received

[5] Ripley Plan 2006, Technical Memo #4 (pdf available on request).
[6] See Exhibit E.
[7] See Exhibit F, p.5.4-21.

relatively little worldwide attention from the Greater Tohoku earthquake, however, is the indirect destruction of structures and underground utilities caused by seismically-induced liquefaction. Recent reporting from Japan, and also from New Zealand on the South Island earthquakes/aftershocks, has revealed stunning images[8] and videos[9] of liquefaction.

On May 17, 2011, I presented 3-minute public testimony to the applicant that included images of uplifted sewer manholes in Urayasu, Japan and Christchurch, NZ caused by seismically-induced liquefaction[10]. One graphic from Urayasu shows a manhole in a residential neighborhood uplifted by approximately four feet. Another graphic from New Zealand shows a 2 kilometer segment of gravity sewer line with 25 consecutive uplifted manholes. Any slight uplift of a sewer pipe, manhole, or lift station would render that tributary sewer service area inoperable since constant pipe slopes and pipe invert elevations are critical to gravity collection performance. On May 13, 2011, Christchurch prepared a map showing extent of inoperable sewers within its city[11]. Thousands of Christchurch homes do not have operable sewers and must resort to use of chemical toilets for the foreseeable future.

In a May 2011 report by the Earthquake Engineering Research Institute (EERI) on the South Island M6.3 February 22, 2011 aftershock, information was provided on the relative performance of PVC and HDPE pipe systems in severe liquefaction events[12]. The performance of PVC water and sewer pipelines is presented as follows.

> *There was extensive damage to lifelines, including potable water, wastewater, and drainage facilities, roads and highways, and electric power distribution. The damage was caused predominantly by liquefaction; differential settlement and lateral spreading disrupted both potable water pipelines (mostly asbestos cement and PVC) and wastewater pipelines (mostly gasketed concrete and PVC). There are likely thousands of breaks and lesser flaws in these networks, and the total number of required repairs is still unknown. Buoyancy of concrete vaults at potable water and wastewater pump stations, compounded by liquefaction-induced settlement, caused pipes to break at connections with the vaults.*

Conversely, the performance of HDPE and MDPE water pipelines is presented as follows.

> *The water distribution network in Lyttelton and Harwood had been replaced with high-density polyethylene (HDPE) pipelines after the September earthquake, and there was not a single instance of damage in that system, although Lyttelton had some of the strongest ground motion recorded in the earthquake, and massive liquefaction was*

[8] See Liquefaction images
[9] See Liquefaction videos
[10] See Exhibit G.
[11] See Exhibit H, note this map was prepared prior to M6.0 June 13 aftershock.
[12] See Exhibit I, page 4.

> *observed in Harwood, including lateral spreading and settlements of 1- 2m. Moreover, there was no damage in the medium-density polyethylene (MDPE) gas distribution system, even though the MDPE pipelines were located in areas subjected to liquefaction during both earthquakes.*

The difference between *"likely thousand of breaks and lesser flaws*" versus "*not a single instance of damage*" is largely attributable to the differing material properties of PVC pipe and HDPE pipe. PVC pipe, while stronger, is relatively brittle and easily subject to cracking and fracture under stress. HDPE is a ductile pipe material that elongates under stress to accommodate ground movement that occurs in liquefiable soils during and after seismic events. Due to the flexibility of HDPE pipe material, HDPE is inappropriate for gravity collection systems where constant pipe slopes and invert elevations are critical to performance. HDPE pipes are commonly used for pressurized water and natural gas distribution as well as pressurized sewer effluent collection.

Applicant's Seismic/Liquefaction Hazard Mitigation
The applicant proposes to mitigate the "very high potential" for liquefaction as follows.

> *Prior to approval of improvement plans, an Emergency Response Plan (ERP) shall be prepared as part of the operation and maintenance plan for the proposed collection system. The ERP shall recognize the potential for liquefaction, seismic hazards and ground lurching, to impact the pipeline or other proposed facilities, and specific high hazard areas shall be inspected for damage following an earthquake. "Soft Fixes" shall be incorporated in the ERP. Soft fixes typically consist of having a plan inplace to address the hazards, such as can be achieved by storing supplies and equipment for repair*[13].

It should be noted that the de facto "soft fix" in Christchurch, NZ is distributing thousands of chemical toilets[14] until such time that the gravity sewers can be repaired or replaced.

Diablo Canyon Nuclear Power Plant Seismic Studies
The Diablo Canyon nuclear power plant is located on the California coastline approximately eight miles south of Los Osos. Seismic safety related to operating a nuclear facility has always been a concern for the residents of San Luis Obispo County, and even more so now since the M9.0 March 2011 Greater Tohoku earthquake/tsunami and resulting multiple safety failures at the Fukushima power plants.

U.S. Senators Dianne Feinstein[15] and Barbara Boxer[16], U.S. Representative Lois Capps[17], as well as geophysicist-trained California State Senator Sam Blakeslee[18] have taken leadership roles in

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[13] See Exhibit F, page 5.4-21.
[14] See Exhibit H.
[15] See Feinstein press release
[16] See Boxer press release

ensuring the seismic safety at the two California coastal nuclear power plants. These four California elected representatives have collectively been successful in suspending the Nuclear Regulatory Commission's relicensing of the Diablo Canyon plant until completion of a 3-year $17 million 3-D earthquake impact modeling study. This study will assess safeguards necessary to protect public health and safety in the event of a severe seismic event anywhere along the central California coastline. This pending study will likely provide new information added to the existing body of knowledge related to seismic hazards along the California central coast as well as seismic hazards specifically within the Los Osos Valley. This new information would be relevant to the Los Osos wastewater project in addition to the Diablo Canyon nuclear plant.

While I do not suggest here that the Los Osos sewer project should be delayed until completion of the Diablo Canyon 3-D seismic study, I do suggest that known seismic hazards need an increased level of scrutiny and attention given to what has recently transpired in Japan and New Zealand.

Cost Implications for Recommended Liquefaction Mitigation

The applicant's mitigation for the liquefaction hazard is limited to "*soft fixes*" that include an Emergency Response Plan[19] which would require "*storing supplies and equipment for repair*." A soft-fix such as this is not a design feature that offers any true mitigation that has any potential to lessen the significant impact of liquefaction. In addition, it is doubtful that any future geotechnical report[20] can do anything of substance to lessen the impact to *less than significant* as asserted by the applicant.

As confirmed by the Christchurch experience, the use of pressure HDPE pipe would fully mitigate the liquefaction risk for the Los Osos sewer collection system. The additional costs for this mitigation would be zero according to the PER, since costs between the PVC and HDPE alternatives are *essentially the same.*

I have on repeated occasions stated that the system as proposed in the Ripley Plan (which includes HDPE pressure collection as a fundamental component) represents a cost savings of at least $50 million (on-lot costs included) relative to the gravity system proposed by the applicant. One such occasion was in public testimony to the California Coastal Commission on June 11, 2010[21]. Most of the savings is in the collection system cost and assumes an efficient delivery under a competitive design-build procurement format. The cost savings would be substantially greater if the applicant's proposed gravity system incorporates "hard-fix" mitigation measures to reduce the liquefaction hazard risks.

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[17] See Capps article
[18] See Blakeslee viewpoint
[19] See Exhibit F, Mitigation Measure 5.4-C2.
[20] See Exhibit F, Mitigation Measure 5.4-C1.
[21] See Exhibit J.

CFR § 1780.57 Design policies.
As confirmed by your February 3, 2011 letter to Congressman DeFazio, there is no ambiguity or issue related to interpretation or applicability of CFR § 1780.57(n) which states:

> *(n) Economical service. The facility's design must provide the most economical service practicable.*

Based on life cycle cost analysis presented in the 2010 PER, the cost for the two alternatives is *essentially the same* and that the HDPE pressure alternative was eliminated for *non-cost factors.*

CFR § 1780.57(o) addresses seismic safety as follows.

> *(o) Seismic safety. Designs of components essential for system operation and substantial rehabilitation of structures that are used for sheltering persons or property should incorporate seismic safety provisions to the extent practicable.*

While my team's 2006 cost analysis obviously is in conflict with the applicant's 2010 PER cost analysis, let us assume for this discussion that the applicant is correct, and that my prior analysis is flawed. Let us assume here that the costs are *essentially the same.*

The issue then becomes whether each of the two systems is in fact "*practicable*." Is the gravity gasketed PVC collection system alternative *practicable* if it offers zero mitigation for the liquefaction hazard while the HDPE pressure collection alternative offers full mitigation at equal or less cost? I would submit that the applicant erred in not removing gravity collection as an alternative in the 2010 PER submitted to the USDA simply because gravity collection is NOT a *practicable* solution for a community with a confirmed high risk of liquefaction. Again, since 1999 the entire Los Osos service area has been mapped on four separate occasions indicating "*High Potential*" or "*Very High Potential*" for seismically-induced liquefaction[22].

The design policies contained in CFR § 1780.57 are unambiguous on lowest cost, seismic safety, and requirement for *practicable* solutions. CFR § 1780.57 clearly brings into question the applicant's decision to advance the one alternative that is inconsistent with these USDA policies and to eliminate the other alternative that is consistent.

Seismic Hazard in Los Osos
The seismic hazards associated with Diablo Canyon have received considerable attention in California from elected representatives including the San Luis Obispo County Board of Supervisors[23] since March 11. For the residents of Los Osos, the risk of severe liquefaction is likely substantially greater than risk of radiation exposure from Diablo Canyon, even though the

[22] See Exhibit E.
[23] See Diablo Canyon article

community is within 8 miles of the nuclear facility. While a significant seismic event off the Central Coast would likely impact both locations, a shutdown of Diablo Canyon would reduce the state's electric power supply by about 10%. A shutdown of the Los Osos sewer system caused by liquefaction would mean either evacuation or chemical toilets for much of the community very similar to what has transpired this year in Christchurch.

Win/Win Way Forward

The clear solution for the applicant's compliance with CFR § 1780.57 is to reinsert the HDPE pressure collection system back in to the project via either a design-bid-build (DBB) or design-build (DB) process. Having been personally responsible for assembling the DB team that proposed HDPE pressure collection in 2008, I am convinced that the DB format will save ratepayers at least 15% relative to the DBB format and that the commissioning date would be one year sooner than the applicant's current scheduled commissioning.

The applicant will likely assert that there is no time for such a change, but that rings hollow since that same statement has been repeated for over 4 years now along with the false claim that the gravity collection project has been "shovel-ready" since 2006. RD Amendment #2 dated April 7, 2011[24] has extended the project timeline sufficiently where no additional time extension would be required. The design requirements for a pressure collection system will require about half the time and half the cost relative to the current "redesign" of the gravity collection system.

Conclusion

Because of the affordability issue associated with this project, cost is of paramount concern to Los Osos ratepayers. My opinion is that the applicant erred in removing the lower cost pressure HDPE collection alternative in 2009, and RUS has the opportunity now to correct this error based on a reconsideration of design policies contained in CFR § 1780.57.

I have elected to copy Senators Feinstein and Boxer, Representative Capps, as well as State Senator Blakeslee because of their advocacy of seismic safety in California. Since this project represents the largest public works project in the history of San Luis Obispo County, and represents the single largest USDA loan by RUS, I believe that the increased scrutiny here is justified. Should RUS agree with the conclusions presented in this letter report, there will be no delay in project implementation if the applicant agrees with your determination by the end of this summer.

[24] See Exhibit K.

I am available to meet with you or your staff in USDA California offices in Davis or Visalia, or Washington D.C. should there be an interest by RUS. My office telephone is 925-847-2086 and email: ripac@comcast.net.

Sincerely yours,
RIPLEY PACIFIC COMPANY

/s/ D.K. Ripley 06.29.11

Dana K. Ripley, P.E.
Principal

cc: U.S. Representative Peter DeFazio
U.S. Representative Lois Capps
U.S. Senator Dianne Feinstein
U.S. Senator Barbara Boxer
California Senator Sam Blakeslee, Ph.D.

List of Exhibits (pdf portfolio on CD enclosed)

Exhibit A	DeFazio letter 121710 and USDA RUS response 020311
Exhibit B	USGS Summary Maps South Island M 7.0, M 6.3, and M 6.0 Earthquakes
Exhibit C	National Water Research Institute Independent Panel Report 2006
Exhibit D	Ripley Pacific Wastewater Update 2006 Executive Summary
Exhibit E	Los Osos Liquefaction Hazard Maps 1999, 2005, 2007, 2008
Exhibit F	LOWWP EIR Section 5.4 Expanded Geology Analysis
Exhibit G	Liquefaction Presentation to SLO Board of Supervisors May 17, 2011
Exhibit H	Christchurch Wastewater System Status Map, May 26, 2011
Exhibit I	EERI Report: The M 6.3 Christchurch, NZ Earthquake of Feb. 22, 2011
Exhibit J	California Coastal Commission Public Testimony, June 11, 2010
Exhibit K	USDA RUS letter, April 7, 2011