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Anti-Degradation Analysis for the Wastewater Treatment and Dispersal System

PACE ENGINEERING
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007103.02

REPORT OF WASTE DISCHARGE

FOR

WASTEWATER TREATMENT & DISPERSAL SYSTEM

FOR THE PROPOSED RETAIL DEVELOPMENT AT

KNIGHTON ROAD & HIGHWAY I-5

SHASTA COUNTY, CALIFORNIA

August 2010

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1. Introduction

This document is a preliminary Report of Waste Discharge (ROWD), including an Antidegradation Analysis (**Appendix E**, herein) for the collection, treatment, and dispersal of wastewater from the proposed retail development (Project) at Knighton Road and Highway I-5, Shasta County, California (**Figure 1**). The purpose of this document is to provide design assumptions, engineering design, and analysis of impacts to the Regional Water Quality Control Board (RWQCB) for their review and comment. Ultimately, the Project proponent would like to receive Waste Discharge Requirements for construction and operation of the wastewater system.

The final version of the ROWD cannot be submitted until an Environmental Impact Report is completed, and a California Environmental Quality Act (CEQA) determination is made.

The Project proponent is:

Mr. Brian Huffaker, Director of Development Services
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The development will consist of approximately 741,000 square feet of commercial development, of which about 26,000 square feet will be restaurants and, the remainder, retail (**Figure 2**). The development will be served by an on-site wastewater treatment and dispersal system.

2. Overview

The sewage collection system will consist of gravity sewer mains to a centrally-located submersible pump station that will convey raw sewage to the on-site wastewater treatment facility.

In order to obtain a level of nitrogen removal to avoid adverse impacts to groundwater quality, the wastewater treatment system will incorporate a nitrification/denitrification step utilizing pre- and post-anoxic basins and Membrane Bioreactors (MBR) for separating liquids from biological solids. The MBR technology allows higher solids concentration in the treatment basin, which provides better control of dissolved oxygen concentration in the recycle stream, and, thus, enhanced nitrogen removal.

The MBR treatment plant will consist of a partially buried, reinforced-concrete basin partitioned into two separate treatment trains. Each train will consist of a series of treatment basins containing the following:

- Pre-Anoxic Basin: In this 6,700-gallon basin, raw sewage will be mixed with return activated sludge from the MBR basin. The microorganisms in the activated sludge will begin consuming the organics in the raw sewage.
- Pre-Aeration Basin: The pre-aeration basin will be a 10,000-gallon basin consisting of fine bubble diffusers which provide an oxygen supply to sustain the colony of microorganisms.
- Post-Anoxic Basin: The 5,000-gallon post-anoxic basin will provide an environment in which the microorganisms in the activated sludge are starved for oxygen, creating a propensity for other oxygenated compounds to become the oxygen source for the microorganisms. For example, oxygen molecules in the compound nitrate are consumed and nitrogen gas is released into the atmosphere; the nitrogen gas released is odorless.
- MBR Basin: The 10,700-gallon MBR basin will contain the submerged membrane units that separate the liquid from the activated sludge.

After this treatment, effluent will be disinfected by ultraviolet light and discharged to the effluent dosing station which will convey the treated effluent to the subsurface dispersal fields at the north end of the site or for reuse as irrigation water on agricultural fields adjacent to the dispersal fields. At full buildout, the wastewater treatment plant will be designed for the following criteria:

Average Dry Weather Flow (ADWF):	53,000 gallons per day (GPD)
Maximum Dry Weather Flow	80,000 GPD
Peak Wet Weather Flow (PWWF):	240,000 GPD
Influent Biochemical Oxygen Demand (BOD):	300 mg/l
Influent Suspended Solids (SS):	250 mg/l
Influent Total Kjeldahl Nitrogen (TKN):	60 mg/l
Effluent BOD:	5 mg/l
Effluent SS:	5 mg/l
Effluent Nitrate as Nitrogen:	3 mg/l

Wastewater dispersal will consist of subsurface dispersal via conventional leach trenches or shallow drip tubes, such as the Geoflow Subsurface Drip System. There are approximately 14.6

acres available for wastewater dispersal at the north end of the site. This entire area will need to be designated as a dispersal area in order to provide 1) adequate separation from shallow groundwater and 2) 100% replacement area per Shasta County standards.

3. CEQA and Other Regulatory Compliance

The Project as a whole is subject to review under the California Environmental Quality Act (CEQA). An Environmental Impact Report is being prepared for the Project, under the auspices of Shasta County.

A treatment and dispersal system that discharges treated wastewater below the ground surface within the property requires Waste Discharge Requirements (WDR) from the RWQCB. If the system were to be designed so wastewater leaves the property via surface-water courses, a National Pollution Discharge Elimination System (NPDES) permit would be necessary. As designed, however, the discharge is not intended to leave the property via surface-water courses, and an NPDES permit will not be required for the wastewater system.

To obtain WDR, the "discharger" (Project proponent) must submit a ROWD, application form, and permit fees. To consider the ROWD complete for review, the final ROWD must contain documentation that CEQA review has been completed (in the form of a Notice of Determination). The RWQCB may informally assist in reviewing the draft ROWD prior to submittal of a final ROWD. The preliminary ROWD herein constitutes a draft version and cannot be considered complete for final review until CEQA is complete.

4. Site Description

The Project site covers 92 acres, and is located in the southeast ¼ of Section 29, T31N, R4W, MDB&M. Assessor's Parcel Numbers (APN) for the Project are 055-160-001, -008, -009, -012, and 055-270-001; the wastewater facilities will be located on APN 055-160-001. The site is immediately adjacent to the northbound I-5 onramp from Knighton Road, and is approximately 1.5 miles east of the Sacramento River. The proposed treatment and dispersal system will be located in the far northern portion of the property (**Figure 2**).

4.1. Land and Water Use

Figure 3 shows the zoning and general land use in the Project vicinity.

APPENDIX E

ANTI-DEGRADATION ANALYSIS

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Figures (following text)

1. Introduction

This document is an Anti-Degradation Analysis for the collection, treatment, and dispersal of wastewater from a proposed retail development (Project) at Knighton Road and Highway I-5, Shasta County, California (**Figures E-1** and **E-2**). This document is part of the Report of Waste Discharge (ROWD) for the Project, and is intended to evaluate the potential impacts to groundwater quality that may be caused by the discharge of treated wastewater to an onsite dispersal area and its reuse for onsite irrigation.

The Project proponent is:

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Mr. Brian Huffaker, Director of Development Services
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The development will consist of approximately 741,000 square feet of retail, dining, entertainment, lodging and travel services, of which about 26,000 square feet will be restaurants (**Figure E-2**). The development will be served by an on-site wastewater treatment and dispersal system, plus facilities to reuse the treated wastewater for irrigation. The wastewater generated will be similar in quality to domestic wastewater, as the Project will not include industrial-type businesses.

2. Applicable Laws and Policies

The federal Clean Water Act (CWA) requires states to adopt, with U.S. EPA approval, water quality standards applicable to all its intrastate waters (*33.U.S.C. §1313*). The CWA also requires that state water quality standards include an antidegradation policy to protect beneficial uses and prevent further degradation of high quality waters (*33 U.S.C. §1313(d)(4)(B); 40 CFR §131.12*). The federal antidegradation policy applies solely to discharges that could affect surface waters (*40 CFR §131.12*).

In California, water quality standards are established in Water Quality Control Plans ("Basin Plans") and the State's antidegradation policy is embodied in Resolution 68-16 ("Resolution 68-16"). Resolution 68-16 applies to surface-water discharges of treated effluent (not proposed for the Project), the dispersal of treated wastewater to on-site dispersal areas and use of reclaimed water for irrigation (proposed for the Project), and the potential impacts to groundwater resulting from the discharge to land of the treated wastewater.

2.1. Federal Antidegradation Policy

The federal antidegradation policy is triggered by a lowering, or potential lowering, of surface water quality.[1,2] Because the Project does not include surface water discharge of treated effluent, the federal antidegradation policy does not apply.

2.2. State Antidegradation Policy and Guidance

2.2.1 Resolution 68-16

The State's Statement of Policy with Respect to Maintaining High Quality Waters in California, "Resolution 68-16", is interpreted to incorporate the federal antidegradation policy, and states, in part:

1. Whenever the existing quality of water is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated to the State that any change will be consistent with maximum benefit to the people of the State, will not unreasonably affect present and anticipated beneficial use of such water and will not result in water quality less than that prescribed in the policies.

2. Any activity which produces or may produce a waste or increased volume or concentration of waste and which discharges or proposes to discharge to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

2.2.2 1987 Policy Memorandum

In 1987, the SWRCB issued a policy memorandum to the Regional Water Quality Control Boards (RWQCB) to provide guidance on the application of the federal antidegradation policy for SWRCB and RWQCB actions, including establishing water quality objectives, issuing NPDES permits, and adopting waivers and exceptions to water quality objectives or control measures. In conducting

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[1] US EPA, 1987, *Guidance on Implementing the Antidegradation Provisions of 40 CFR 131.12.*

[2] SWRCB, October 1987, *Memorandum from William R. Attwater to Regional Board Executive Officers Federal Antidegradation Policy.*

these actions, the RWQCBs must assure full protection of existing instream beneficial uses, that the lowering of water quality is necessary to accommodate important economic or social development, and that outstanding national resource waters be maintained and protected.

2.2.3 Administrative Procedures Update 90-004

In 1990, the SWRCB issued guidance to the RWQCBs for implementing Resolution No. 68-16 in NPDES permitting in Administrative Procedures Update (APU) 90-004. Because APU 90-004 applies specifically to NPDES permitting actions, its application is limited to surface water discharges. As such, it does not apply to this Project, because the treated effluent will not be discharged to surface waters.

3. Water Quality Standards, Groundwater Beneficial Uses

In California, "basin plans" prepared by the RWQCB describe beneficial uses and their corresponding water quality objectives (defined per federal regulations as water quality standards). A significant difference between the state and federal programs is that California's basin plans establish standards for ground waters in addition to surface waters.

The applicable basin plan for the Project site is the *The Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region, Fourth Edition, Revised September 2009 (with approved amendments): The Sacramento River Basin and the San Joaquin River Basin*. The Basin Plan give this description of the beneficial uses of groundwater:

> *"Unless otherwise designated by the Regional Water Board, all ground waters in the Region are considered as suitable or potentially suitable, at a minimum, for municipal and domestic water supply (MUN), agricultural supply (AGR), industrial service supply (IND), and industrial process supply (PRO)."*

The Basin Plan contains the following objectives for all groundwater of the Sacramento and San Joaquin River Basins. The objectives do not require improvement over naturally occurring background concentrations. The groundwater objectives in the Basin Plan are not required by the federal Clean Water Act.

- Bacteria: In groundwater used for domestic or municipal supply (MUN), the most probable number of coliform organisms over any seven-day period shall be less than 2.2/100 ml.

- Chemical Constituents: At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels (MCLs) specified in the following provisions of Title 22 of the California Code of Regulations, which are incorporated by reference into this plan: Tables 64431-A (Inorganic Chemicals) and 64431-B (Fluoride) of Section 64431, Table 64444-A (Organic Chemicals) of Section 64444, and Tables 64449-A (Secondary Maximum Contaminant Levels-Consumer Acceptance Limits) and 64449-B (Secondary Maximum Contaminant Levels-Ranges) of Section 64449. Groundwater used for municipal or domestic supply shall not contain lead in excess of 0.015 mg/L.

- Radioactivity: At a minimum, groundwater designated for use as domestic or municipal supply (MUN) shall not contain concentrations of radionuclides in excess of the maximum contaminant levels (MCLs) specified in Table 4 (MCL Radioactivity) of Section 64443 of Title 22 of the California Code of Regulations.

- Taste and Odor: Ground waters shall not contain taste- or odor producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

- Toxicity: Ground waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with designated beneficial use(s). This objective applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances.

4. Summary of Available Water Quality Data

4.1. Groundwater Occurrence

Regional groundwater aquifers beneath the site and vicinity occur in the Tehama and Tuscan Formations, with most wells in the area completed in the Tehama Formation. Wells in the immediate vicinity of the site range in depth from less than 100 feet bgs (older domestic wells or newer monitoring wells) to about 500 feet bgs, and pump from the Tehama or younger formations.[3]

The regional groundwater gradient is towards the Project site, towards the axis of the basin. **Figure E-3** shows the site in relation to the Redding groundwater basin, and the direction of the groundwater gradient as mapped by the California Department of Water Resources. Generally, groundwater in the

[3] Department of Water Resources (DWR) drillers logs on file, Red Bluff, CA.

Tehama Formation occurs in a semiconfined to confined condition in the central part of the Redding groundwater basin.

Beneath the Project site, there are at least four aquifer zones – an upper, perched zone between about 10 and 35 feet below ground surface (bgs); from 108 to 125 feet bgs ("upper"); 158 to 209 feet ("intermediate"); and 240 to 330 feet ("deep"). The upper two zones are separated from the lower zone by a clay layer from 209 to 240 feet below ground surface. The Production Well for the Project was completed below the clay layer; the 81-foot-long screened interval extends from 244.5 to 325.5 feet bgs.

Static water levels in the upper and intermediate aquifers are about 30 feet bgs; water level in the lower aquifer is about 52 feet bgs. The similarity in water levels in the upper and intermediate aquifers suggests that these two zones could be considered as one aquifer.

Depth to the shallowest groundwater beneath the site varies between about 11 and 25 feet bgs. **Figure E-4** shows a graph of depth to water beneath the site, as measured since July 2008. **Figures E-5** and **E-6** show maps of the shallow groundwater gradient for July and December 2008. The direction of the shallowest groundwater gradient is to the south. This makes the proposed dispersal area upgradient of the rest of the Project property and downgradient or cross-gradient of the residential areas surrounding the site.

The shallowest groundwater occurs during the summer, in the irrigation season. Shallow groundwater reaches its minimum depth in about mid-June to early July, and then remains high until irrigation stops in mid-October (about 120 days). After irrigation in the area stops, water levels decline, and then rise occasionally with precipitation events.

4.2. On-Site Groundwater Quality

Water quality beneath the site has been sampled at various times between 1999 and 2008. In 1999, water quality in the intermediate and deep aquifers was sampled. **Table E-1** shows those results.

In 2008, water quality in the shallowest aquifer was sampled for nitrogen compounds. The intent of this sampling was to characterize the total nitrogen concentration of the shallowest aquifer so that an appropriate level of treatment could be developed to avoid adverse impacts. **Table E-2** shows those results. **Figure E-7** shows a map of the results from the July 2008 sampling event.

Table E-1: Water Quality in the Intermediate & Deep Aquifers

Analyte	Units	Intermediate Aquifer	Deep Aquifer	MCL
General Parameters				
Alkalinity	mg/L	107	73	NE
Calcium	mg/L	18	18	NE
Chloride	mg/L	6.44	4.58	250-500-600
Hardness	mg/L	120	78	NE
Magnesium	mg/L	10	11	NE
Nitrate As N	mg/L	<0.08	1.84	10
Sodium	mg/L	10	11	NE
Sulfate	mg/L	4.53	7.36	250-500-600
Total dissolved solids	mg/L	108	154	500-1000-1500
Metals				
Aluminum	µg/L	302	<50	1000
Antimony	µg/L	<6.0	<6	6
Arsenic	µg/L	<2	6	10
Barium	µg/L	<100	<100	1000
Beryllium	µg/L	<1	<1	4
Cadmium	µg/L	<1	<1	5
Chromium	µg/L	<10	<10	50
Copper	µg/L	<50	<50	1300
Iron	µg/L	**421**	<100	300
Lead	µg/L	<5	<5	15
Manganese	µg/L	<30	110	50
Mercury	µg/L	<0.2	<0.2	2
Nickel	µg/L	<10	1	100
Selenium	µg/L	<5	<5	50
Thallium	µg/L	<1.0	<1.0	2
Zinc	µg/L	311	<50	5000

Notes: MCL = maximum contaminant level; NE = Not established;
bold-face type = exceeds MCL.

Table E-2: Nitrogen Sampling Results for Shallow Aquifer

		Nitrogen, Total	Nitrate + Nitrite	Total Kjeldahl Nitrogen
		(mg/L)	(mg/L)	(mg/L)
P-1	7/14/2008	2.25	2.05	0.2
P-1	8/13/2008	4.91	1.21	3.7
P-2	8/13/2008	4.13	2.53	1.6
P-3	7/14/2008	7.58	6.98	0.6
P-3	8/13/2008	12.00	5.14	6.9
P-6	7/14/2008	4.40	0.20	4.2
P-6	8/13/2008	0.43	0.03	0.4
P-7	8/13/2008	6.45	0.65	5.8
P-8	8/13/2008	0.59	0.09	0.5
P-9	7/14/2008	2.05	2.05	<0.5
P-9	8/13/2008	5.34	2.24	3.1
P-10	7/14/2008	1.41	1.21	0.2
P-10	8/13/2008	1.42	0.32	1.1
P-11	8/13/2008	43.2	0.06	43.1
Mean		4.07	1.90	2.36
Median		4.13	1.21	1.35
75th percentile		5.34	2.24	3.83
95th percentile		9.35	5.88	6.30
Standard deviation		3.29	2.07	2.34
Confidence		95%	95%	95%
95% confidence interval		1.79	1.13	1.32
Mean lies between		2.28 and 5.86	0.77 and 3.03	1.04 and 3.68

Note: P-11 not used in calculations because it is significantly higher than the other values.

5. Estimated Effluent Quality

5.1. Treatment Technology

To obtain a level of nitrogen removal that would not cause adverse impacts to groundwater with an approximate background nitrogen concentration of 2 mg/L, the wastewater treatment system is essentially an activated sludge biological treatment process that will incorporate nitrification/denitrification utilizing pre- and post-anoxic basins and Membrane Bioreactors (MBR). The MBR technology replaces the secondary clarification step in activated sludge and provides a high degree of solids removal because membranes create a physical barrier between the mixed liquor and permeate (secondary effluent). In addition, the MBR activated sludge process provides

enhanced nitrogen removal because the operator can better control dissolved oxygen concentrations. **Figure E-8** shows a process diagram of the treatment and dispersal system.

The MBR treatment plant will consist of a partially buried reinforced-concrete basin partitioned into two separate treatment trains. Each train will consist of a series of treatment basins containing the following:

- Pre-Anoxic Basin: In this 6,700-gallon basin, raw sewage is mixed with return activated sludge (RAS) from the MBR basin and/or aerated wastewater from the Pre-Aeration Basin. The microorganisms in the activated sludge begin consuming organics in the raw sewage and respire oxygenated compounds such as nitrate from the RAS.
- Pre-Aeration Basin: The pre-aeration basin is a 10,000-gallon basin consisting of fine bubble diffusers which provide an oxygen supply to sustain the colony of microorganisms and convert anoxic nitrogen compounds to oxygenated compounds.
- Post-Anoxic Basin: The 5,000-gallon post-anoxic basin provides an environment in which the microorganisms in the activated sludge are starved for oxygen creating a propensity for other oxygenated compounds to become the oxygen source for the microorganisms. For example, oxygen molecules in the compound nitrate are consumed and nitrogen gas is released into the atmosphere.
- MBR Basin: The 10,700-gallon MBR basin contains the submerged membrane units that separate the liquid from the activated sludge. This liquid (effluent) is highly treated and meets discharge requirements for Biochemical Oxygen Demand (BOD), suspended solids and, most likely, nitrate. The likely effluent limits for nitrate are very low and near the limitation for biological treatment. As part of the design, space and connection points for a future ion exchange treatment process (or other processes, such as methanol addition) will be provided, in case biological treatment, alone, is inadequate to remove nitrate to low enough levels to meet final effluent limits. The ion exchange process is the exchange of ions of the same charge between a solution (wastewater) and an insoluble solid (specialized media).
- Membrane Thickener Basin: In order to keep solids within the treatment system in balance, solids will be periodically wasted to the membrane thickener. The membrane thickener consists of a fine bubble aeration system and flat plate membrane modules, similar to the modules in the MBR basin. Periodically, solids will be removed from the membrane thickener, at approximately 3% solids concentration, and hauled to Shasta County's Septage Handling Facility near the Anderson Landfill. Permeate from the membranes will be returned back to the MBR treatment process.

After MBR treatment, the effluent will be disinfected by ultraviolet radiation, and then discharged to the effluent-dosing station which conveys treated effluent to the subsurface dispersal fields at the north end of the site.

5.2. Projected Effluent Quality

Table E-3 shows the anticipated influent quality (assumed to be similar to commercial-strength wastewater), taken from various published sources and the anticipated effluent quality after the above-described treatment.

Table E-3: Influent (Pretreated) & Effluent (Treated) Wastewater Concentrations

Constituent	Units	Average Influent Assumed For This System	Anticipated Effluent Quality From This System	Sources
BOD_5	mg/L	300	<5	1
Total Kjeldahl Nitrogen	mg/L	60	0	2
Total Nitrogen	mg/L	60	<3 (As Nitrate)	1
Total Suspended Solids	mg/L	250	<5	1

Sources of Data: 1. Enviroquip, a Division of Eimco Water Technologies.
2. Wastewater Engineering, Treatment and Disposal, Metcalf and Eddy, 3rd Edition.

6. Constituents of concern

Based on testing results from northern California wastewater treatment plants (Cottonwood, Dunsmuir, Mt. Shasta City), the following constituents may be present in the untreated effluent from the Project:

Acrylimide
Benzo(a)pyrene (PAH's)
Biological oxygen demand (BOD)
Cadmium
Copper
Cryptosporidium
Fecal coliform and *E. Coli*
Giardia lamblia
Nutrients (nitrogen & phosphorous compounds)
Suspended solids
Total coliforms
Total dissolved solids
Turbidity
Vinyl chloride
Viruses
Zinc

The proposed wastewater treatment system can be considered "state-of-the-art" and is designed to effectively treat typical constituents that may be present, such as those observed in local wastewaters.

7. Water-Quality Impacts Analysis

Groundwater quality impacts could come from downward migration of effluent constituents below the dispersal area. To evaluate this potential impact, a groundwater model, previously developed for the site, was used.[4,5] The model is a three-dimensional, numerical model using the publicly available program ModFlow, developed by the United States Geological Survey. **ROWD Appendix C** contains a description of the model developed for this site.

To evaluate potential water-quality impacts of the proposed dispersal, a recharge area of 562 feet × 582 feet was added to the groundwater model. The recharge rate was set at 1437 inches per year [(80,000 gallons/day ÷ 7.48 gallons/cubic foot)) ÷ 318,092 square feet × 12 inches/foot × 365 days/year]. The recharge concentration was set at 3 mg/L, assumed to be total nitrogen. The model was run for 30 years, at this recharge rate and concentration.

This scenario is conservative in that not all of the effluent will be dispersed – some will be used for irrigation during the summer. This will reduce the amount of effluent percolating to groundwater, as well as reduce the concentration of nitrogen and other constituents in the percolating effluent (some constituents will be taken up by the irrigated plants).

Using the conservative assumptions, the modeling shows that, with the proposed level of treatment, the level of nitrate will not be significantly higher than it is now. **Figures E-9**, **E-10**, and **E-11** show maps of the modeled nitrate concentrations in the aquifers; the distribution of nitrate (or any other constituent) is different between the aquifers because the aquifer have differing directions of groundwater movement:

- In the uppermost, perched aquifer (about 11 to 25 feet bgs), nitrate attributable to the Project wastewater could extend up to 600 feet from the north, west, and east property lines; detectable levels would not extend past the southern property line (**Figure E-9**). Assuming a background nitrate level of 2 mg/L, treated wastewater from the Project would not be distinguishable from background levels outside of the site, and beneath most of the site itself.

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[4] L&A, February 1999, *Effects of Wastewater Disposal on Ground Water at Flying J Knighton Road Travel Plaza Shasta County, California.*

[5] L&A, August 2006, *Wastewater Evaluation for the Proposed Shasta Regional Auto Mall, Knighton & I-5, Shasta County, California.*

There should be no drinking-water wells completed in this zone, because all wells must have a minimum 20-foot surface seal. That is, this zone should be sealed off to nearby drinking-water wells.

- In the upper aquifer within about 300 feet of the northern and eastern property lines, nitrate attributable to Project wastewater would be between 1 and 2 mg/L, and nondetected beyond that (**Figure E-10**). In the upper aquifer to the southeast, less than 1 mg/L of nitrate attributable to Project wastewater could extend to about 2,000 feet from the property line.
- In the intermediate aquifer, detectable levels of nitrate from Project wastewater will not extend past the north or west property lines (**Figure E-11**). Nitrate from Project wastewater between 0.1 mg/L and nondetectable (0.01 mg/L) may extend up to 1,600 feet from the eastern property line.
- Domestic wells to the south, completed in the intermediate aquifers would not capture detectable nitrate from the Project.
- Detectable levels of nitrate from the Project wastewater will not occur in the deep aquifer.
- The existing site well would not capture detectable levels of nitrate from the Project.

There will be no impairment to surface water. The dispersal system will be designed to accommodate the anticipated flow without causing wastewater to surface. This would be an unacceptable condition, and would not be permitted by the RWQCB or other authorities.

Because the effluent will be disinfected there will be no impacts from biological organisms.

8. Costs, Benefits, & Socio-Economic Impacts of Alternatives For Maintaining Existing Water Quality

There are two viable alternatives – either No Project or the Proposed Project. The alternative of connecting to an existing sanitary sewer system is not feasible. The nearest system is that of the City of Redding and the Project site is not within the City boundary. There currently are no plans to annex the Project area to the City of Redding. Generally, property owners in the vicinity of the Project area have not expressed a desire for annexation to the City. Because the Project site is not contiguous with the City of Redding boundary, it could not be annexed alone, as it would create an "island" of City area; this is not allowed by the Local Area Formation Commission (LAFCO). Therefore, because annexation to the City is unlikely to occur, it is infeasible to connect the Project's wastewater system to the City's sewer

8.1. No Project Alternative

With a No Project Alternative, there would not be any additional or new costs. The property would continue to be used as it has been - irrigated or dry land agriculture, pasture, or vacant and unutilized land (as it has been for the last number of years).

There would be no additional or new economic or public benefit. Selling of agricultural products produced at the site (currently only hay) presumably generates some tax revenue.

Groundwater quality would remain similar to current conditions, assuming no additional residential development in the area. Additional residential development could cause impacts to groundwater quality from on-site disposal of untreated wastewater.

8.2. Proposed Project

The cost of the wastewater treatment system for the Proposed Project will be borne solely by the Project proponent; no public monies will be used to fund the system. The estimated cost to construct the facilities, to full build out, is about $5.15 million dollars.

The level of treatment to be provided for the wastewater is such that background groundwater quality will not be adversely affected. The discharge of the treated effluent to the subsurface, or as irrigation water, will not cause groundwater downgradient of the Project to be significantly different than upgradient of the Project.

The public benefit derived from the new discharge that is necessary to accommodate the project development is an important consideration as part of the antidegradation analysis. The following factors were considered in determining whether the economic or social development is consistent with maximum public benefit:

- Tax Benefits
- Public Infrastructure
- Financial Responsibility for Private Treatment Facility
- Estimated Jobs Creation

8.3. Tax Benefits

In addition to the typical increase in property value and the associated increase in taxable value created by the construction of a development such as this, a draft Fiscal Impacts Analysis (FIA) prepared by Economic & Planning Systems, Inc (EPS), dated October 12, 2009, estimates this

project will generate approximately $3,122,635 in annual revenue at full build out. After project-related expenses are considered, the FIA estimates the County's General Fund and Public Safety Fund will experience annual surpluses of $1.4 million and $715,000, respectively.

In addition to the annual project-generated revenues, it is expected that this development will generate approximately $3.9 million in various county, school, and road impact fees.

8.4. Public Infrastructure

As a part of the development improvements, the applicant will be constructing a number of improvements to the surrounding County road system. Knighton Road will be reconstructed to more efficiently maneuver the traffic on and off of I-5. Churn Creek will be expanded to better handle the local traffic. There is no independent estimate of the cost of these improvements, but Hawkins Companies anticipate these costs to be approximately $2.3 million.

In addition to the actual improvements constructed as a part of the construction of this development, the Project proponent will be participating in some mitigation improvements along the I-5 corridor.

8.5. Fiscal Responsibility for Private Treatment Facility

Both the construction and ongoing maintenance of the treatment facility will be the responsibility of the applicant and shall not be an expenditure burden on the County tax revenues.

8.6. Estimated Jobs Creation

This project will create various types of jobs through the construction and operation of the business occupants. According to the FIA, it is estimated that approximately 1,647 retail jobs will be created. Additional construction jobs will be created for the construction of both the development improvements as well as the surrounding roadways.

9. Proposed Discharge Identified as Providing / Not Providing Maximum Benefit To the State

The proposed discharge will not have an adverse impact to groundwater underlying the site. The Project, including the wastewater treatment and dispersal system will be constructed and operated with private funds. The Project will generate $3,122,635 in annual revenue at full build out; the County's General Fund and Public Safety Fund will show annual surpluses of $1.4 million and $715,000, respectively, from Project tax revenues.

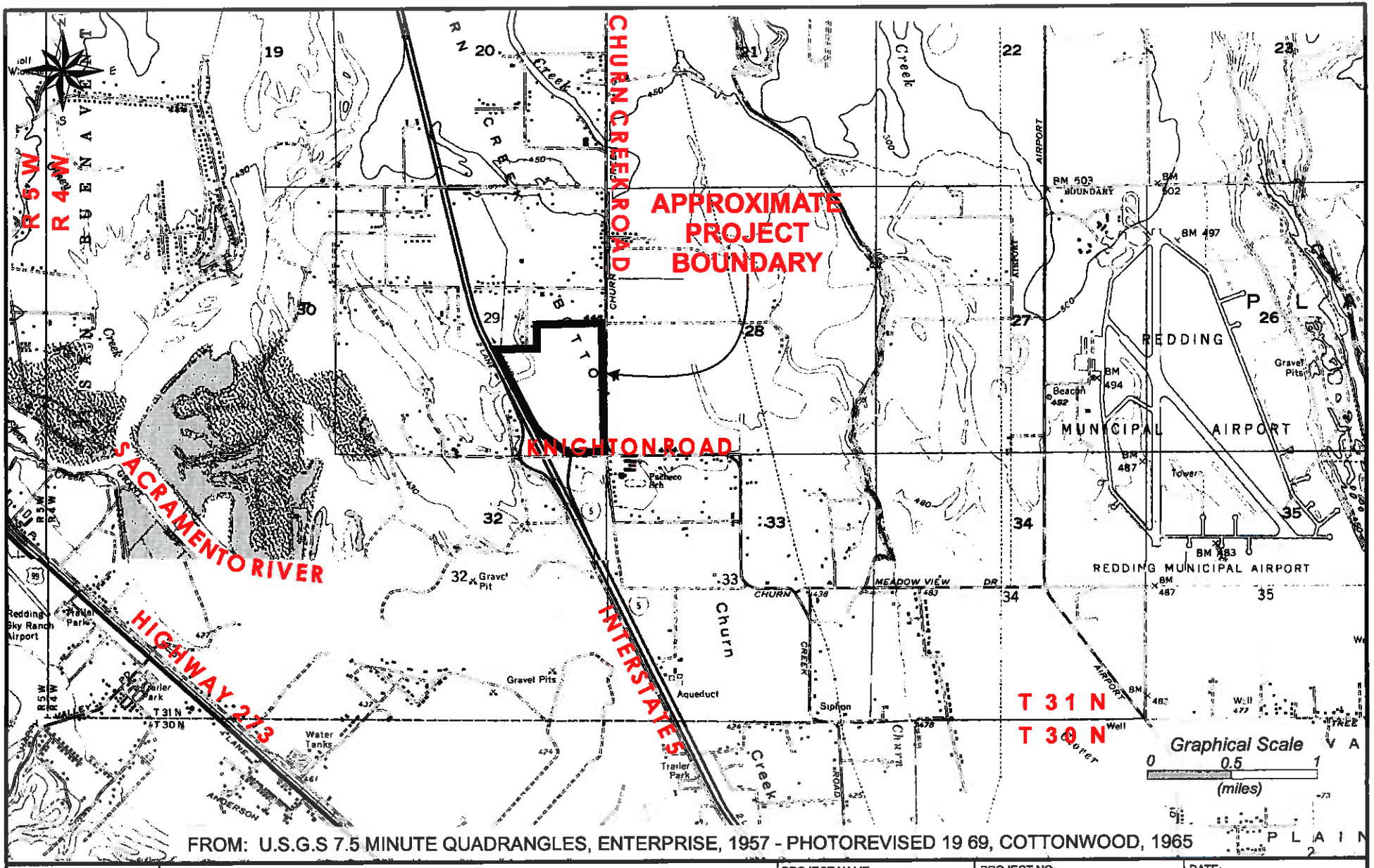
Therefore, the proposed discharge will provide maximum benefit to the State.

10. Evaluation of Consistency With Antidegradation Policy

As described above, the discharge will not unreasonably (or adversely) affect present and anticipated beneficial use of the groundwater, and will not result in water quality less than that prescribed in the policies. In consideration of the economic benefits to be derived from the Project, any less than significant changes in groundwater quality attributable to the discharge will be consistent with maximum benefit to the people of the State,

The proposed waste discharge is anticipated to meet Waste Discharge Requirements that will be issued for the discharge. The proposed treatment and dispersal system represents the current "best practicable treatment and control" of the discharge, to assure that (a) a pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained.

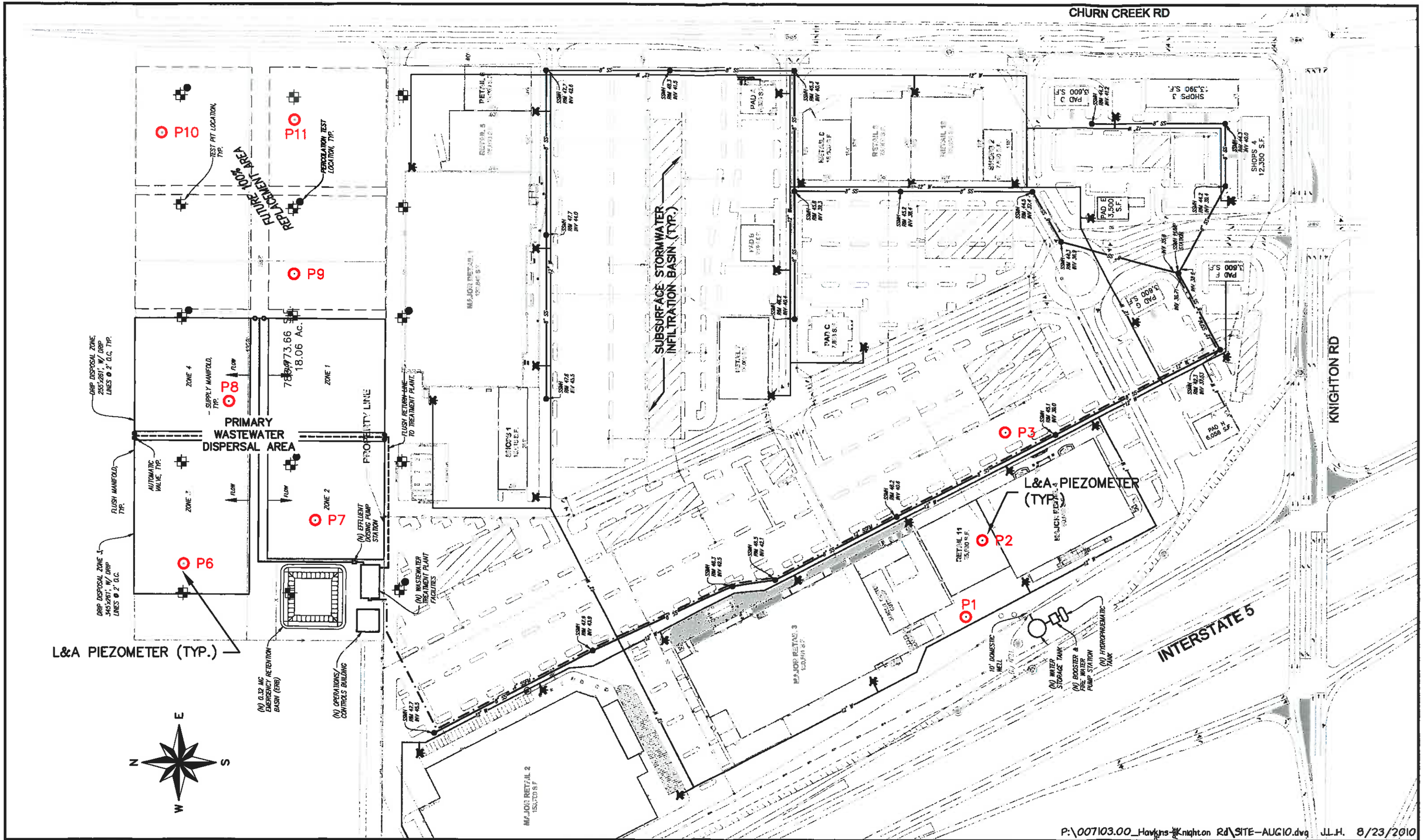
Therefore, the proposed discharge is consistent with the State of California's Antidegradation Policy.



LAWRENCE & ASSOCIATES
ENGINEERS & GEOLOGISTS

LOCATION MAP
KNIGHTON ROAD DEVELOPMENT
SHASTA COUNTY, CALIFORNIA

PROJECT NAME: ANTIDEGR. ANALYSIS	PROJECT NO: 007103.02	DATE: AUGUST 3, 2010
CLIENT: HAWKINS COS.	DRAWN BY: B. LAMPLEY	FIGURE E-1
SCALE: 1 INCH ~ ½ MILE	CHECKED BY: B. GARTNER	



P:\007103.00_Hawkins-Knighton Rd\SITE-AUG10.dwg J.L.H. 8/23/2010

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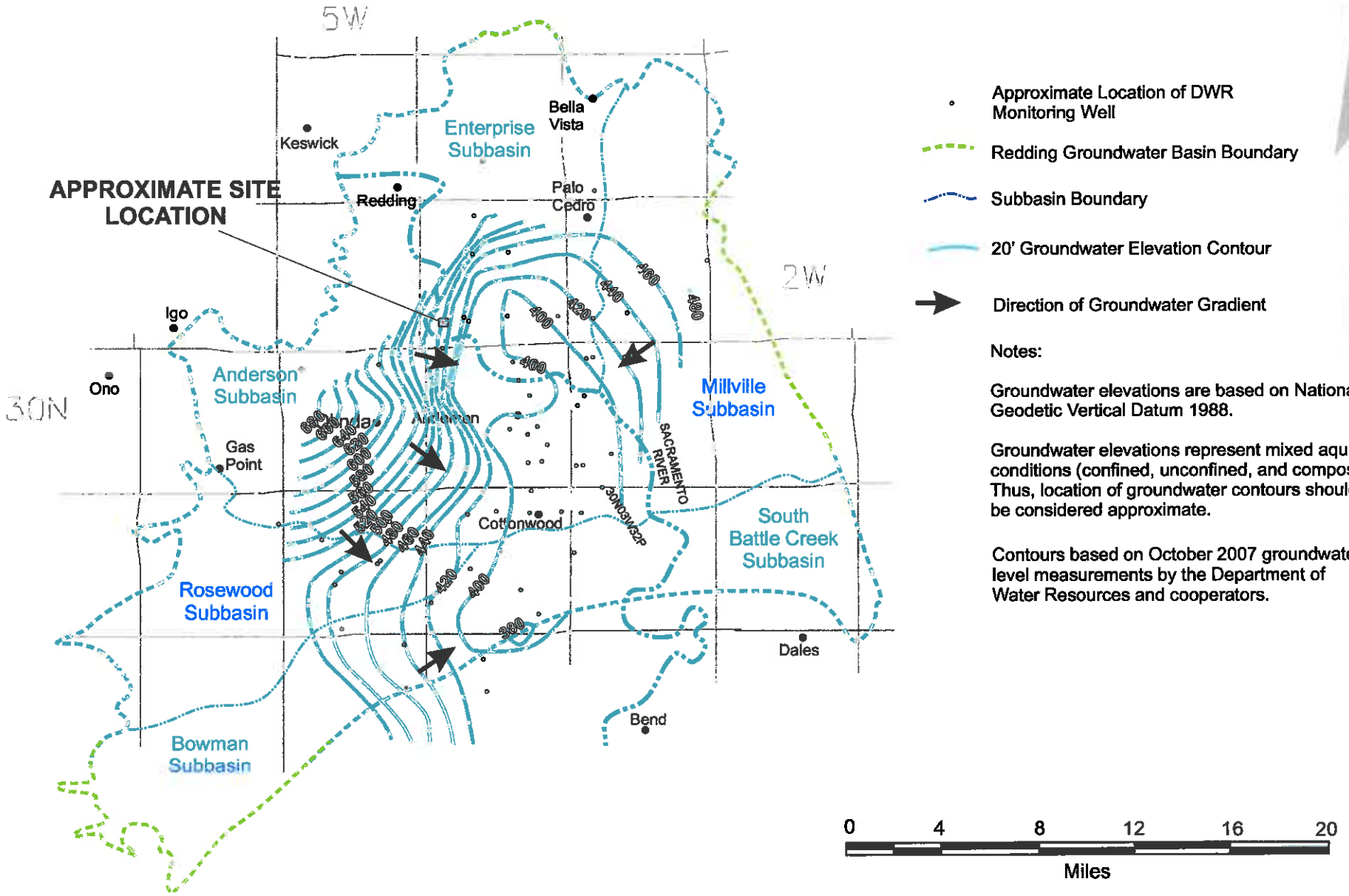
SITE PLAN SHOWING WASTEWATER TREATMENT SYSTEM AND DISPERSAL AREA

(MAP ADAPTED FROM PACE ENGINEERING, PRELIMINARY UTILTIY PLAN 8-19-10)

ANTIDEGRADATION ANALYSIS

HAWKINS COMPANIES

PROJECT NO: 007103.02	SCALE: 1"=200'
DRAWN BY: J. HOLDEN	DATE: 8/23/2010
CHECKED BY: B. LAMPLEY	FIGURE E-2



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REGIONAL GROUNDWATER ELEVATION CONTOURS
REDDING BASIN - FALL 2007
DEPARTMENT OF WATER RESOURCES DATA

PROJECT NAME: ROWD	PROJECT NO: 007103.02	DATE: JULY 29, 2010
CLIENT: HAWKINS COS.	DRAWN BY: B. LAMPLEY	FIGURE E-3
SCALE: 1 INCH ~ 9,000 FEET	CHECKED BY: B. GARTNER	

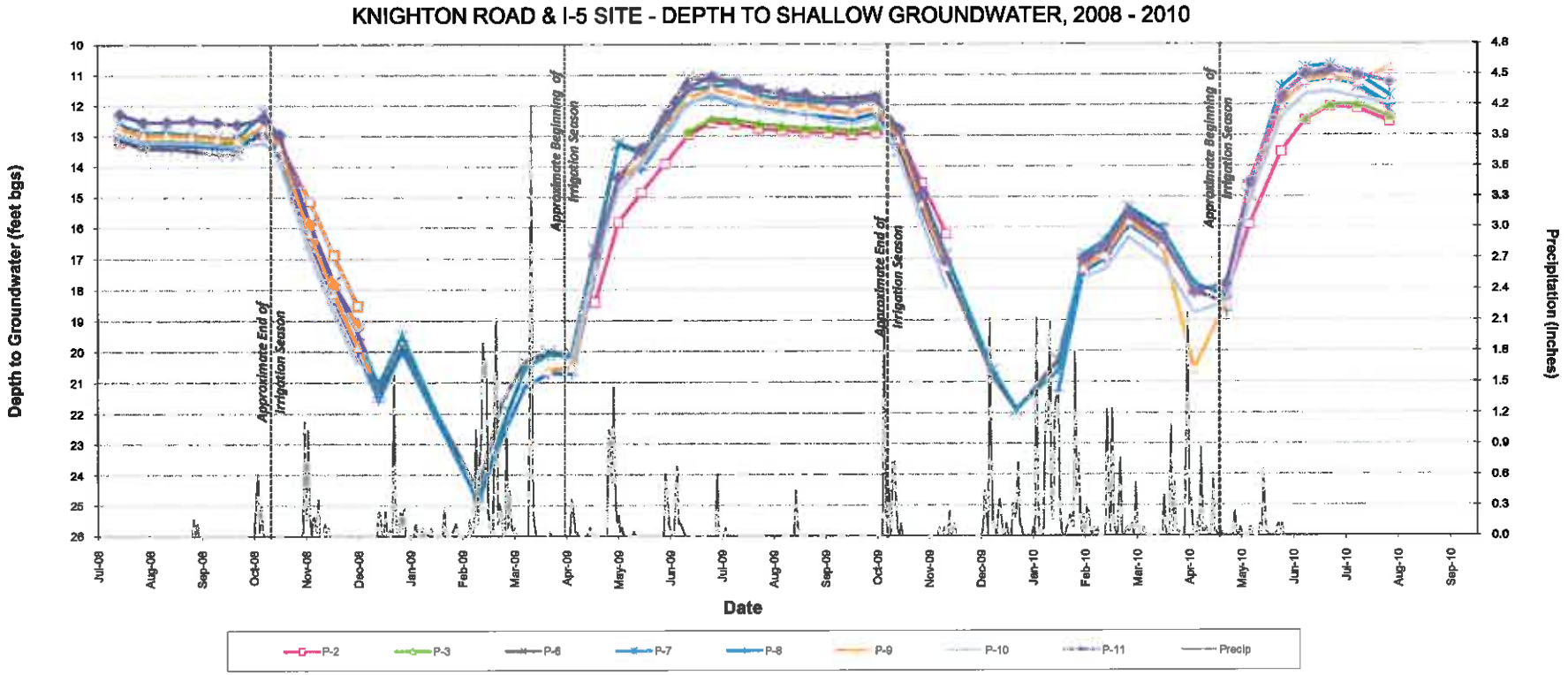
KNIGHTON ROAD & I-5 SITE - DEPTH TO SHALLOW GROUNDWATER, 2008 - 2010
Depth to Groundwater (feet bgs)
Precipitation (inches)
Date
Approximate End of Irrigation Season
Approximate Beginning of Irrigation Season
Approximate End of Irrigation Season
Approximate Beginning of Irrigation Season
P-2
P-3
P-6
P-7
P-8
P-9
P-10
P-11
Precip

FIGURE E-4

LAWRENCE & ASSOCIATES
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GROUNDWATER ELEVATION CONTOUR MAP
JULY 28, 2008

ANTIDEGRADATION ANALYSIS

HAWKINS COMPANIES
KNIGHTON ROAD DEVELOPMENT

PROJECT NO: 010073.02	SCALE: 1 INCH ~ 200 FEET
DRAWN BY: B. LAMPLEY	DATE: JULY 29, 2010
CHECKED BY: B. GARTNER	FIGURE E-5

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GROUNDWATER ELEVATION CONTOUR MAP
DECEMBER 2, 2008

ANTIDEGRADATION ANALYSIS

HAWKINS COMPANIES
KNIGHTON ROAD DEVELOPMENT

PROJECT NO: 010073.02	SCALE: 1 INCH ~ 200 FEET
DRAWN BY: B. LAMPLEY	DATE: JULY 29, 2010
CHECKED BY: B. GARTNER	FIGURE E-6

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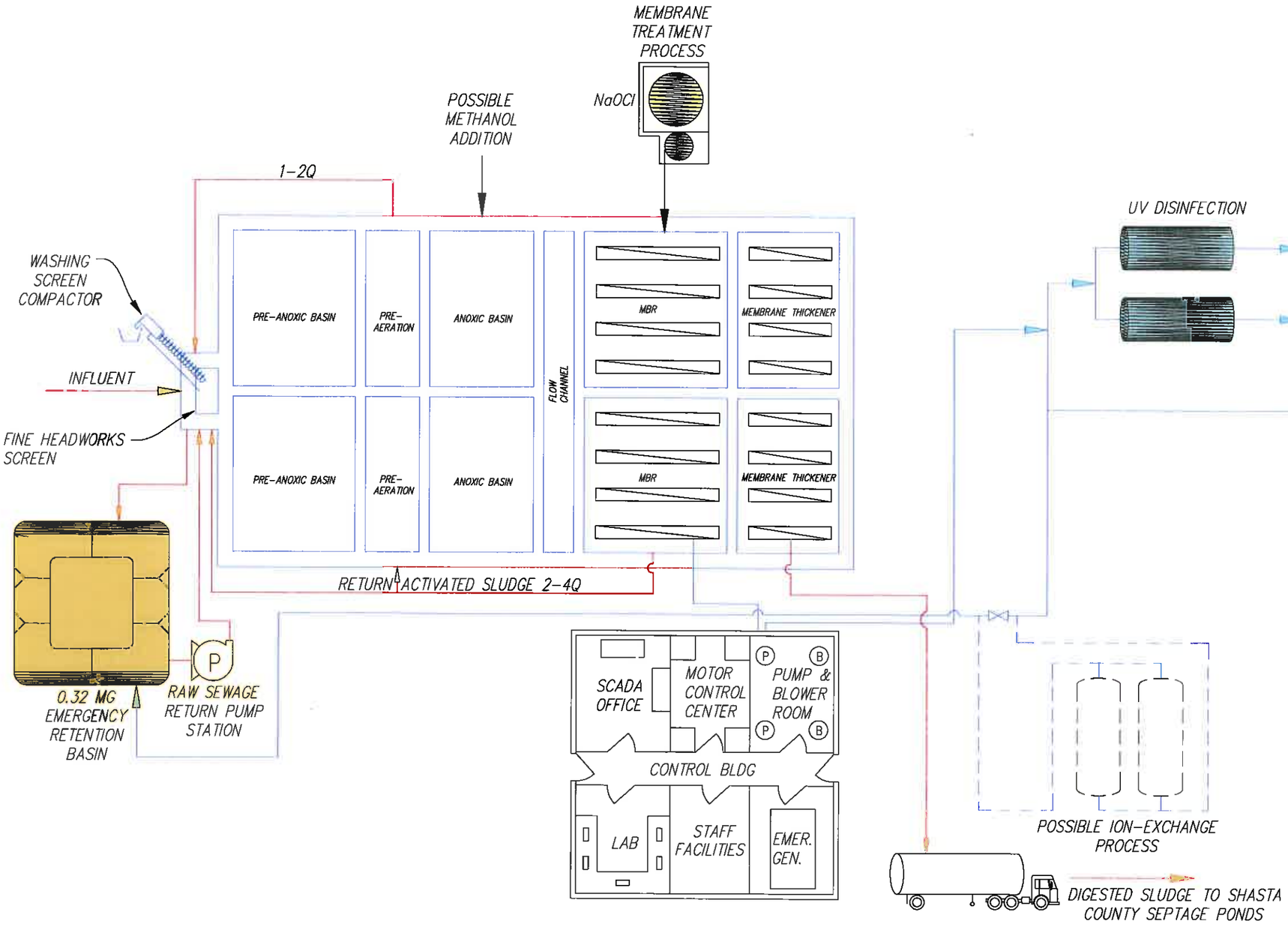
NITRATE & NITRITE AS NITROGEN AND TOTAL KJELDAHL NITROGEN
JULY 28, 2008

ANTIDEGRADATION ANALYSIS

HAWKINS COMPANIES
KNIGHTON ROAD DEVELOPMENT

PROJECT NO: 010073.02	SCALE: 1 INCH ~ 200 FEET
DRAWN BY: B. LAMPLEY	DATE: JULY 29, 2010
CHECKED BY: B. GARTNER	FIGURE E-7



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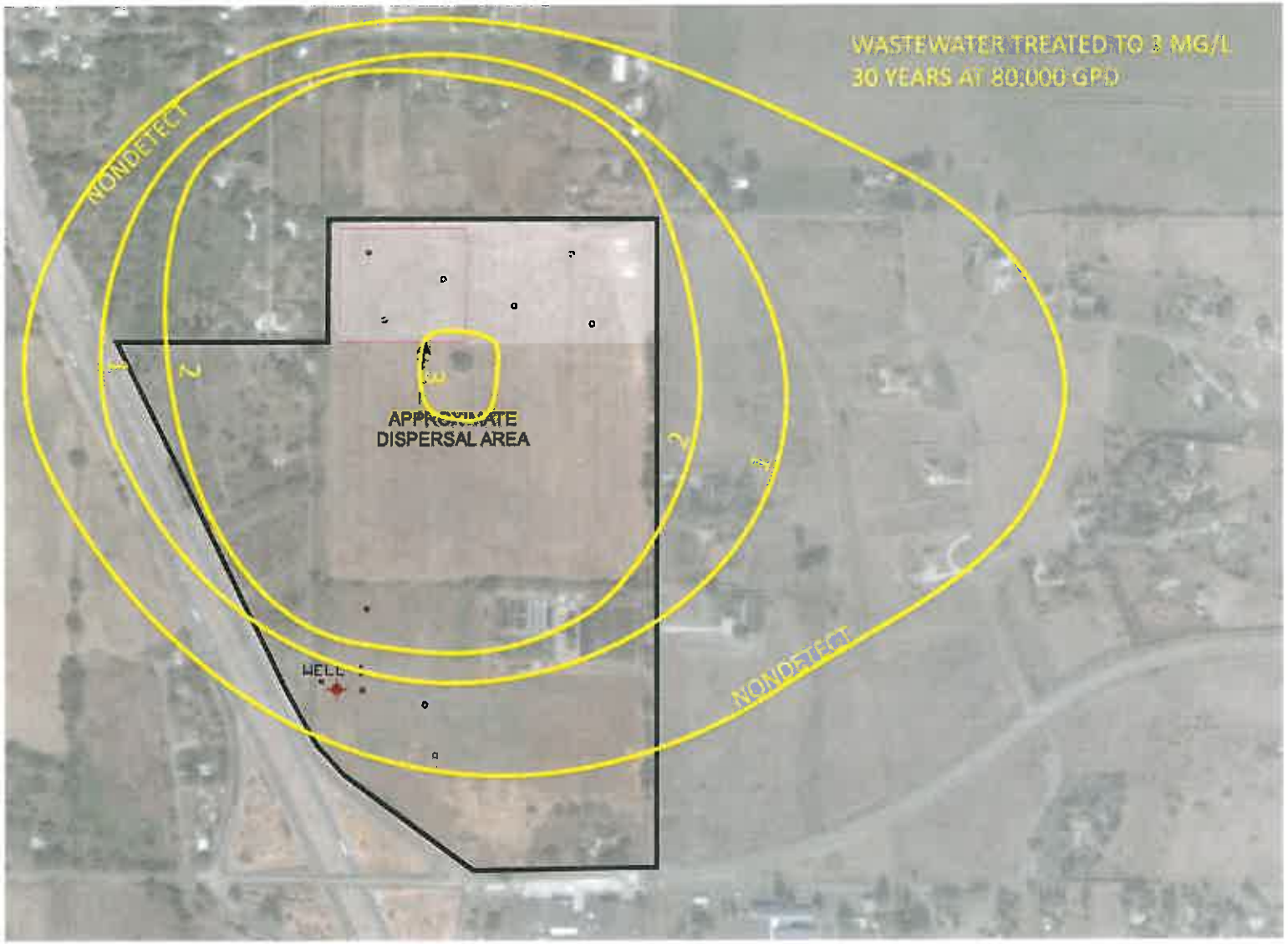
WASTEWATER TREATMENT SYSTEM PROCESS DIAGRAM
FROM: PACE CIVIL, INC., AUGUST 2010

ANTIDEGRADATION ANALYSIS

HAWKINS COMPANIES
KNIGHTON ROAD DEVELOPMENT

PROJECT NO: 010073.00	SCALE: NTS
DRAWN BY: B. LAMPLEY	DATE: AUGUST 2010
CHECKED BY: D. KIRK	FIGURE E-8



NORTH

Line of equal nitrate+nitrite concentration, mg/L — 1 mg/L

Nondetect = Current analytical detection limit of 0.1 mg/L

Piezometer

Scale ~ 1 inch = 800 feet.

0' 800'

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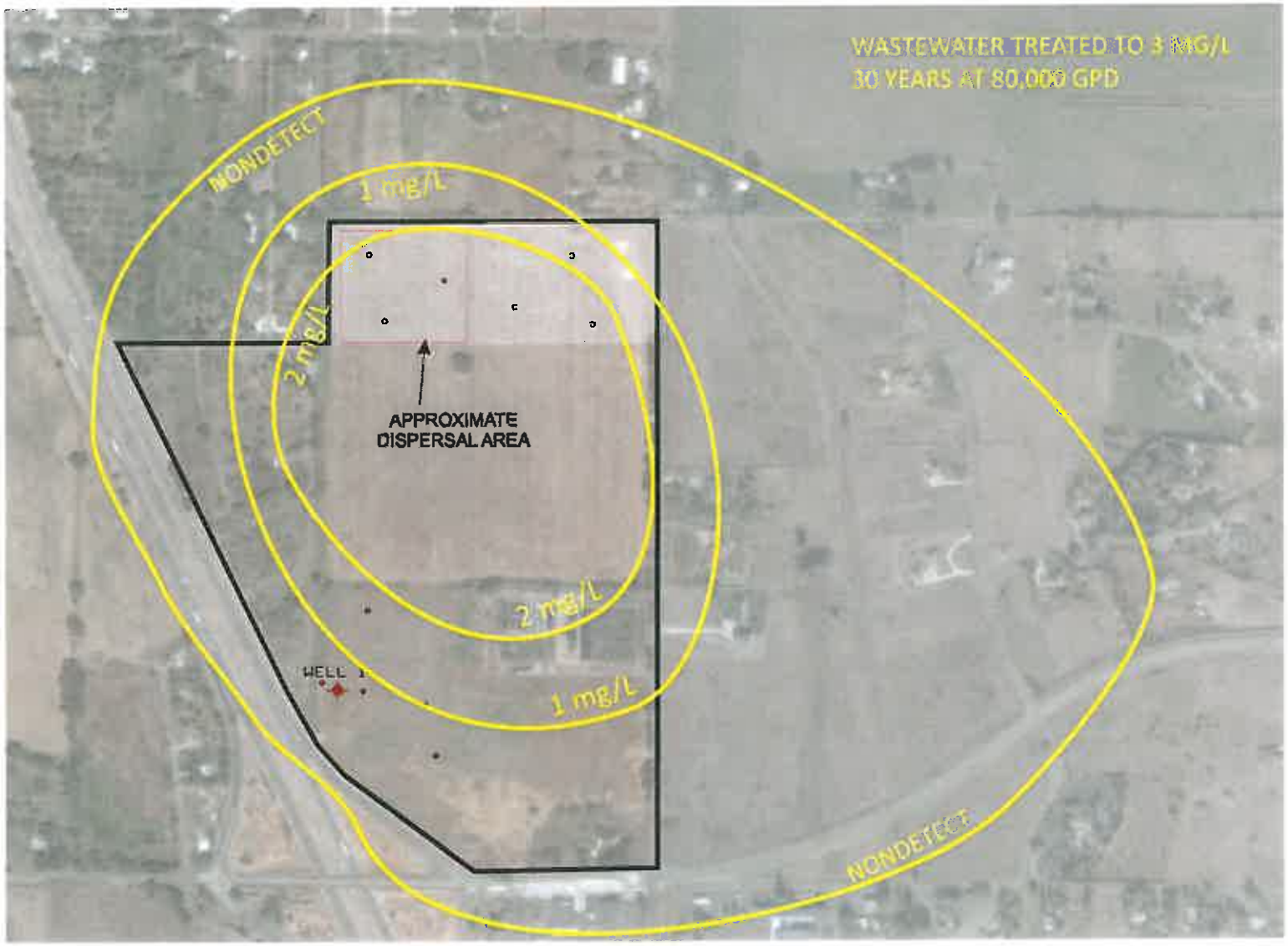
NITRATE IN PERCHED AQUIFER ATTRIBUTABLE TO WASTEWATER, BACKGROUND GROUNDWATER CONCENTRATION = 2 MG/L

PROJECT NAME: ANTIDEGR. ANALYSIS	PROJECT NO: 007103.02	DATE: AUGUST 3, 2010
CLIENT: HAWKINS COS.	DRAWN BY: B. LAMPLEY	FIGURE E-9
SCALE: 1 INCH = 800 FEET	CHECKED BY: B. GARTNER	



NORTH

Line of equal nitrate+nitrite concentration, mg/L — 1 mg/L

Nondetect = Current analytical detection limit of 0.1 mg/L

Piezometer

Scale ~ 1 inch = 800 feet.

0' 800'

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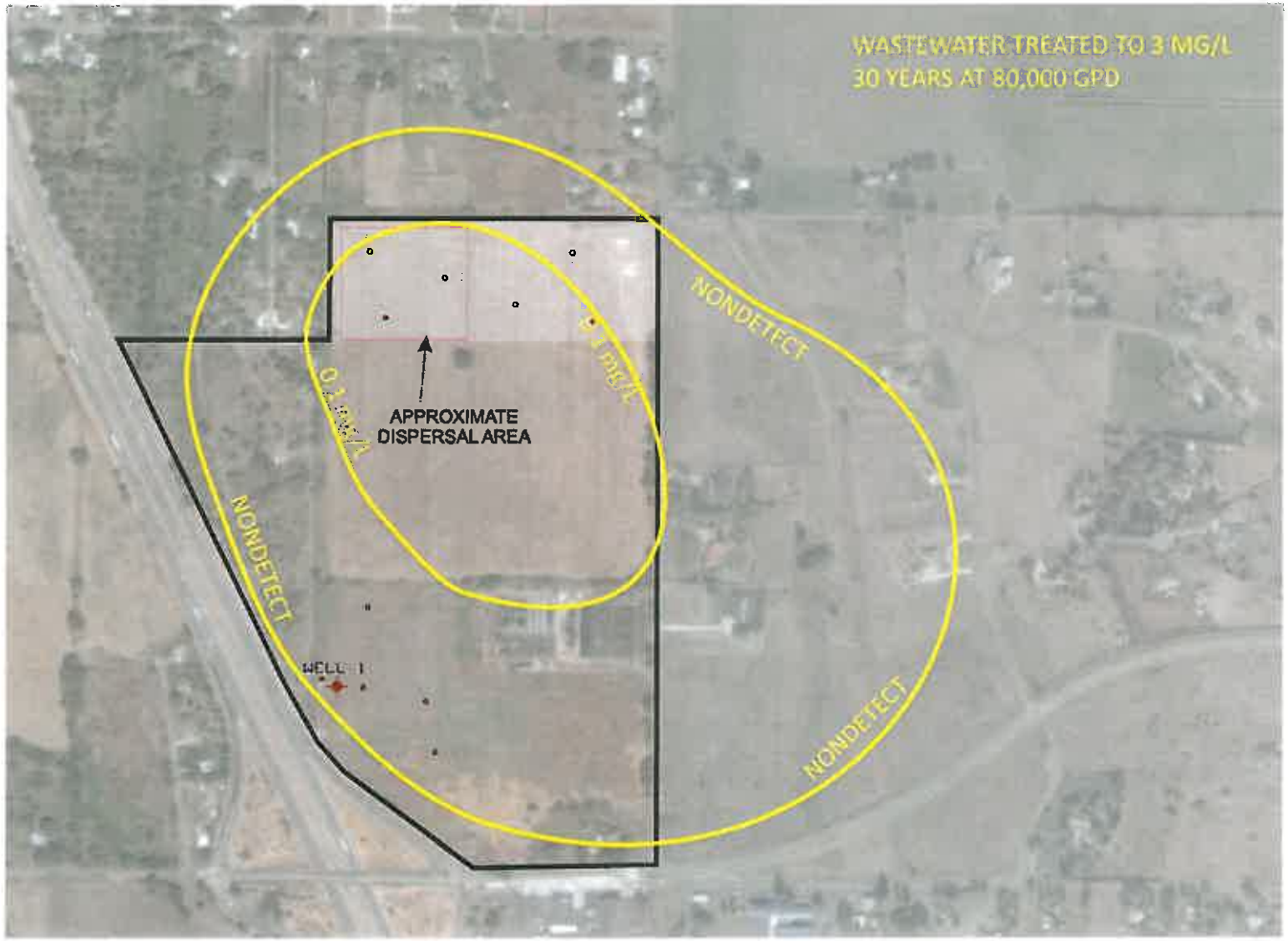
NITRATE IN UPPER AQUIFER ATTRIBUTABLE TO WASTEWATER, BACKGROUND GROUNDWATER CONCENTRATION = NONDETECT

PROJECT NAME: ANTIDEGR. ANALYSIS	PROJECT NO: 007103.02	DATE: AUGUST 3, 2010
CLIENT: HAWKINS COS.	DRAWN BY: B. LAMPLEY	FIGURE E-10
SCALE: 1 INCH = 800 FEET	CHECKED BY: B. GARTNER	



NORTH

Line of equal nitrate+nitrite concentration, mg/L — 1 mg/L

Nondetect = Current analytical detection limit of 0.1 mg/L

Piezometer

Scale ~ 1 inch = 800 feet.

0' 800'

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NITRATE IN INTERMEDIATE AQUIFER ATTRIBUTABLE TO WASTEWATER, BACKGROUND GROUNDWATER CONCENTRATION = NONDETECT

PROJECT NAME: ANTIDEGR. ANALYSIS	PROJECT NO: 007103.02	DATE: AUGUST 3, 2010
CLIENT: HAWKINS COS.	DRAWN BY: B. LAMPLEY	FIGURE E-11
SCALE: 1 INCH = 800 FEET	CHECKED BY: B. GARTNER	