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Technical Memorandum

Prepared for: Stoel Rives LLP Attorneys at Law

Project Title: CDO Response

Project No.: 148680

Technical Memorandum [No. 3]

Subject: Odor Monitoring and Mitigation Plan

Date: January 11, 2016

To: Kristen T. Castaños, Partner

From: Rob Beggs, Project Manager

Copy to: Ross Oliveira

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Limitations:

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Table of Contents

List of Tables

List of Figures

This technical memorandum (TM) provides input by Brown and Caldwell (BC) regarding the development of a new odor monitoring and mitigation plan for The Morning Star Packing Company.

Section 1: Introduction

The Morning Star Packing Company, L.P. (Morning Star) owns and operates the Morning Star Tomato Packing Plant in Colusa County, California, which includes settling and cooling ponds, as well as approximately 485 acres of associated land application area (LAA). The discharge of wastewater generated by the facility is regulated by the Central Valley Regional Water Board under Waste Discharge Requirements (WDR) Order No. R5-2013-0144. This section provides background on the Morning Star plant, odor sources, and history of complaints and violations.

1.1 Odor Complaint and Violation History

In August 2015, following one public odor complaint to the County Health Department on August 6 and four during August 11 through August 14, the Regional Water Board staff conducted an inspection of the facility and identified several potential sources of objectionable odors. On September 11, 2015, the facility was issued a Notice of Violation (NOV) requiring Morning Star to produce a plan and schedule for compliance with several items in the WDR. Odor complaints were recorded on four additional days in September. Following Morning Star's response to the NOV, the Board staff issued a Tentative Cease and Desist Order (CDO) on November 20, 2015, which is scheduled for Board action in February 2016. This odor monitoring and mitigation plan is prepared in anticipation of Board action on the Tentative CDO.

1.2 Odor Sources

Regional Board staff has indicated concern that odors may have been emitted by the cooling pond, settling pond and LAA fields in 2015. Following are descriptions of these identified odor sources at the Morning Star Tomato Packing Plant.

1.2.1 Cooling Pond

The cooling pond is used to cool condensate process water from the evaporation process prior to recycle back to the factory for use in the condensate loops and flumes. The cooling pond has not received regular boiler blowdown or water softener reject water for years since those systems were replumbed. Incidental overflow from the cooling pond enters the irrigation canal to the LAAs. As a matter of normal operation documented in the 1995 Report of Waste Discharge and the 1995 Waste Discharge Requirements, the condensate can contain low concentrations of organic compounds in vapor carryover from the tomato paste.

The cooling pond was expanded from 60 acres in footprint to 100 acres in 2015 in proportion to the 65% factory process capacity expansion documented in the 2013 Waste Discharge Requirements. The expansion of the cooling pond in 2015 resulted in a reduction in available LAA of about 90.5 acres. The new evaporators installed prior to the 2015 season also had some misdirected plumbing which allowed for two sidestreams with substantial concentrations of organics to end up in the cooling pond. This misdirected plumbing is now rectified.

1.2.2 Settling Pond

The settling pond is used to treat tomato waste generated in the flume system, the supernatant of which is applied to the LAA. The settling pond was also expanded prior to the 2012 season from a footprint of about 0.92 acres to about 2.0 acres.

1.2.3 Land Application Area

Prior to the 2015 season, the LAA consisted of about 600 acres of cropland owned by Morning Star, in addition to about 95 acres of periodically leased cropland, used to apply wastewater at agronomic rates. The current area of the LAA is approximately 485 acres.

1.3 Odor Emissions Analysis

Due primarily to transitional issues with startup of the expanded processing facilities and the water conservation measures instituted as part of industry-wide drought response efforts, the average biochemical oxygen demand (BOD) concentration for wastewater applied to the LAA was approximately 2.5 times higher in 2015 than in 2014. Based on professional experience of BC engineers and the description of odor conditions by Morning Star staff, the most likely sources of anaerobic odors were particular distribution ditches and fields in the LAA. The higher wastewater strength likely caused more odor generation in areas of stagnant water.

Field MS6 was an experiment in irrigating rice with the wastewater effluent, and was loaded at a much higher rate than the likely natural aeration capacity. Ditches in some of the more remote northern areas of the ranch also reportedly had stagnant water. While these were not problematic in previous years with lower wastewater BOD concentrations, they became problematic in 2015 with the higher wastewater strength.

Due to its high temperature, large surface area, and sometimes depressed dissolved oxygen (DO), the cooling pond may have been a source of volatilized slightly degraded tomato odors. Because of high vacuum and temperature, the water from the final condenser loop likely has inherently low DO. The misdirected plumbing associated with the new evaporators (which has since been corrected) contributed excess organics which may have further depressed DO.

The settling pond is a relatively small area compared to the LAA and Cooling pond. There were some periods of low DO in the settling pond in 2015, but the settling pond is much less likely to be a source of odors to offsite receptors.

Section 2: Odor Complaints in 2015

The County Health Department received odor complaints early in the 2015 processing season and notified Morning Star. In response, Morning Star started evaluating potential sources of odors and began a regular monitoring program in mid-August 2015. Following are data related to the complaints and the monitoring program conducted by Morning Star.

2.1 Public Odor Complaints

Table 2-1 details odor complaints recorded by outside parties in the vicinity of Morning Star's Facility.

Table 2-1. 2015 Odor Complaints Attributed to Morning Star Reported by the Public or Other Agencies in 2015

Date		Reporting Party	Location	Odor Level (# Complaints)	Notes
August	6	County Health	Not given	Not given	-
	11-14	County Health	Not given	Not given	-
	20	Board staff	Abel/Husted	Slight (1)	-
September	10	City of Williams	Crawford Road	Not given	Several odor complaints over multiple days
	21	County Health	Butte View Dr.	Not given	Afternoon-evening hours
	25	County Health	Butte View Dr.	Not given	Afternoon-evening hours
	27	County Health	Butte View Dr.	Not given	Afternoon-evening hours

2.2 Odor Monitoring Observations

Morning Star staff started subjective manual odor monitoring in mid-August at on-site locations shown in Figure 2-1 and off-site locations shown in Figure 2-2. Monitoring was continued through 10/14/2015. Table 2-2 summarizes the monitoring results. Odors were rated during the monitoring according to the following designations:

- 1 = None to Slight
- 2 = Slight
- 3 = Medium

A value in the table indicates that an odor was detected at least once during the day at the given location.

The results of 2015 odor monitoring indicate that off-site odors were primarily detected at the Valley Ranch location and at the intersection of Crawford and Zumwalt. Days on which more significant on-site odors were detected generally correlated with days on which off-site detections were also made. All results except two were reported as none-to-slight or slight in terms of odor intensity.

Table 2-2. Morning Star 2015 Odor Monitoring Results												
Date	On Site Odor Observations[1]					Off Site Odor Observations[1]						
	MS2, MS3	Abel / Husted	Husted/ I-5	Old 99	MS 16	House (SW)	Sac Museum (W)	Chevron (C)	Police Station (NE)	Valley Ranch (SE)	Crawford/ Zumwalt (W)
8/14											
8/15											
8/16											
8/17											
8/18											
8/19											
8/20											
8/21				2							2
8/22	2, 2, 2	2, 2, 3	2, 2	1, 1, 1	1, 2, 2					1	1, 1, 2
8/23	2, 2	2, 2	2, 2		1, 1						
8/24	2, 2, 2	1									1
8/25	1, 1, 2	1, 2, 2								1	
8/26	1, 2, 2	2, 2, 2	2								
8/27	2, 2, 2	2, 2, 2	2, 2	2, 2	2, 2, 2						
8/28	2, 2, 2	2, 2, 2	1, 2	1, 1, 2	1, 2, 2						1
8/29	2, 2, 2	2, 2, 2	1, 2	2, 2	1, 2, 2			1		1	1, 1
8/30	2, 2, 2	2, 2, 2		1, 2	2, 2, 2						
8/31	2, 2, 2	2, 2, 2	2	1, 1	2, 2, 2						1
9/1	2, 2, 2	2, 2, 2	2, 2, 2	1, 2, 2	2, 2, 2					1	1, 2
9/2	2, 2	2, 2	2, 2	2, 2	2, 2					1, 1	2, 2
9/3				2, 2, 2							
9/4	2	1	1	2							
9/5				1, 2							
9/6		2	2	1, 2	1, 1						
9/7		1			1						
9/8											
9/9											
9/10											
9/11											
9/12											

Table 2-2. Morning Star 2015 Odor Monitoring Results

Date	On Site Odor Observations[1]					Off Site Odor Observations[1]					
	MS2, MS3	Abel / Husted	Husted/ I-5	Old 99	MS 16	House (SW)	Sac Museum (W)	Chevron (C)	Police Station (NE)	Valley Ranch (SE)	Crawford/ Zumwalt (W)
9/13		1		1							
9/14	1, 1	2, 2, 2	2, 2, 2	2, 2, 2	1, 2					1, 1, 1	1, 1, 1
9/15	1	2	1	1	2					1	1
9/16	1, 2, 2	1, 2, 2	1, 2, 2	1, 2, 2	1, 2, 2					1, 1, 2	1, 1, 2
9/17											
9/18		1			2						
9/19											
9/20			1, 1		1, 2						
9/21	1	1	1	1	1					1	
9/22	1, 2, 2	1, 2, 2	1, 2, 2	1, 2, 2	1, 2, 2					1, 1	1, 1, 1
9/23	1, 2	2	2	2	1, 2					1	1
9/24	1, 2, 2	1, 2, 2	2	2	1, 1, 2					1	1
9/25		1	1	1	2, 2, 3						
9/26	2	1, 1, 2	1, 1, 2	1, 2	1, 1, 2						
9/27	1, 2, 2	1, 2, 2	1, 1, 2	1, 1, 2	1, 2, 2					1	1, 1
9/28	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2					1	1
9/29	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2					1, 1, 1	1, 1, 1
9/30	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2					1, 1, 1	1, 1, 1
10/1	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2	2, 2, 2					1, 1	1, 1
10/2	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1						
10/3	1				1, 1, 1						
10/4	1	1	1		1, 1						
10/5	1, 1, 1	1, 2, 2	1, 1, 1	1, 1, 1	1, 1, 1						
10/6	1, 1	1, 2	1, 1	1, 2	1, 2						
10/7	1, 1, 1	1, 1, 1	1, 2, 2	1, 1, 1	1, 1, 1						
10/8	1	1	1	1	1						
10/9	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1						
10/10	1, 1				1, 1						
10/11			1	1							
10/12	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1						

Table 2-2. Morning Star 2015 Odor Monitoring Results											
Date	On Site Odor Observations[1]					Off Site Odor Observations[1]					
	MS2, MS3	Abel / Husted	Husted/ I-5	Old 99	MS 16	House (SW)	Sac Museum (W)	Chevron (C)	Police Station (NE)	Valley Ranch (SE)	Crawford/ Zumwalt (W)
10/13	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1						
10/14	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1	1, 1, 1						

1. *Values in cells represent odor levels: 1 = None to slight, 2 = Slight, 3 = Medium. Each set of values within a single cell represents distinct odor observations taken at different times of day. Odors that were recorded as "None" are not shown.*

Section 3: Recommended Odor Monitoring for 2016 Season

Among the requirements proposed in the Tentative CDO issued to Morning Star in November 2015 was the planning and implementation of a real-time odor monitoring plan during the 2016 processing season. The odor monitoring plan presented here involves three phases of monitoring, as outlined below. Each of these phases is detailed in succeeding sections.

The three proposed phases of odor monitoring are as follows:

1. **Phase 1:** Field measurement using subjective ratings and instrumentation readings throughout the 2016 season
2. **Phase 2:** Air sampling at highest risk odor sources in the middle of the 2016 season
3. **Phase 3:** Possible automated monitoring if warranted in 2017

3.1 Phase 1: Field Measurement using Instrumentation

This phase aims to determine the major odor sources and sinks, and builds on the 2015 odor monitoring effort conducted by Morning Star. It includes a combination of manual and automated field measurements aimed at determining sources, time periods, intensities, and character of odors occurring at and around the facilities. Some similar monitoring was carried out by Morning Star in 2015 (see Section 2). The proposed suite of measurements incorporates only those sites where odors were detected and augments this manual monitoring with instrumentation.

3.1.1 Assumptions

This level of analysis was developed based on the assumptions that:

1. The most objectionable odor-causing compounds that could emanate from the site are primarily sulfide-based. As a primary odorous compound, hydrogen sulfide (H_2S) retains a familiar "rotten egg" odor and is the most prevalent odorous compound in wastewater and wastewater-related systems. Therefore, measurement of H_2S is often considered a reasonable surrogate for all contributing odorous compounds in several wastewater treatment processes. If other compounds are determined to be more prevalent, this will be determined in subsequent phases.
2. The odor sources are assumed to be primarily associated with the LAAs with some possible contribution from the settling and cooling ponds. Although the settling and cooling ponds were identified by Board staff as potential major odor sources, the results of further evaluation indicate that they are less likely to be significant sources of anaerobic odors. Issues other than odor issues for the cooling pond and settling pond are discussed in greater detail in a separate technical memorandum.

3.1.2 Monitoring Times and Locations

Manual field measurements will be conducted around the times of day when at least "none to slight" odors were detected in 2015 monitoring. The data indicate that this was usually in the early mornings and late afternoons. Therefore, BC recommends field measurements during those times, on a weekly basis during the tomato processing season. Additional field measurements could be taken if significant off-site odors are detected.

In terms of field measurement locations, BC recommends only monitoring at locations where odors were detected in 2015 monitoring, plus the southeast corner of field MS11. This includes all on-site locations and three out of six off-site locations, specifically, the Valley Ranch Southeast, Crawford and Zumwalt and Chevron Central locations (Table 3-1). BC recommends replacing the I-5/Husted on-site location with the southeast corner of field MS11 to better capture any odors from the cooling pond and setting pond.

Continuous odor monitoring is most effective close to potential sources. We recommend one location at the northeastern corner of field MS2 (referred to as MS2/MS3 in 2015) and one at the southeast corner of field MS11.

3.1.3 Monitoring Instrumentation

BC proposes three types of odor field measurements, all of which should ideally be conducted simultaneously:

1. Manual odor assessment performed on- and off-site by field personnel: This would be conducted similar to 2015 monitoring, but only at the times and locations where/when odors were detected in 2015 monitoring. We also recommend using a numeric scale to classify the odor strength, rather than a qualitative scale as used in 2015 monitoring. For example, a scale ranging from 1 to 5, where 1 indicates no odor and 5 indicates a highly offensive odor is preferred for reporting.
2. Instrumental measurements at the same times and locations where manual odor assessment is conducted, using:
   a. At a minimum, a Jerome 605 Analyzer or equivalent to measure hydrogen sulfide (H_2S) concentrations. This is a hand-held instrument that provides a measurement in typically less than 30 seconds. Hydrogen sulfide concentration is measured by the instrument down to a resolution of 1 part per billion by volume (ppbv). This lower bound is approximately equal to the threshold of human detection for H_2S. This instrument is also able to detect other reduced-sulfur compounds like dimethyl sulfide or methyl mercaptan at about 10% of the concentration at which H_2S is detected. This instrument may be rented for use during the monitoring period

   b. An olfactometer like the NasalRanger™ or equivalent to approximate ambient odor levels. The Nasal Ranger is used to quantify how "detectable" ambient odors are without specifying an actual odor source or quantifying a particular compound (such as H_2S). The intent of the instrument is to be able to scientifically quantify the "total odor" at any given location, taking into account the combined effect of all odorous compounds that may be in the ambient air. This instrument may be rented for use during the monitoring period.
3. Continuous and automated odor monitoring using an OdaLog®. This device is a data logger that measures the ambient H_2S concentration continuously and records the measured concentration in a data file that can be downloaded onto a personal computer and analyzed. While the OdaLog primarily measures H_2S, this compound may be used here as an important surrogate for other odorous compounds. The low-range OdaLog measures the ambient H_2S concentration every five minutes continuously at the installed location. The advantage of the low-range devices is that they can measure down to a concentration of 10 ppbv (two orders of magnitude below the standard

loggers). Any measurement below 10 ppbv is recorded as zero. The data is available in either graphical or tabular format and can be analyzed for the monitoring period, or in a single day. The software provides an average, minimum, and maximum concentration for each device over the course of the week of monitoring. We also recommend that the northern OdaLog have internet connectivity via cell modem for real time access to data.

The advantage of this instrument is that it can be set up and allowed to run throughout the monitoring period. Alternative instrumentation with similar functionality to the OdaLog will also be considered.

4. In addition to odor monitoring, routine analytical monitoring of Dissolved Oxygen (DO) and Oxidation-Reduction Potential (ORP) (on-site only) in the settling and cooling ponds should also be performed, preferably around the same time that on-site and off-site odor measurements are taken. This would enable the ability to relate detected on-site odors to potential odorous gases being produced out of the ponds. We assume that the facility already has access to DO and ORP meters. If not, these instruments may be rented for use during the monitoring period.
5. Weather monitoring should be performed during the sampling period, specifically, of wind speed and direction, as was conducted during 2015 monitoring.

3.2 Phase 2: Air Sampling at Suspected Odor Sources

After at least one month of Phase 1 monitoring to identify the highest risk odor sources, BC recommends sampling and laboratory analysis of ambient air to determine the “total odor” and subsequently the actual composition of odorous compounds. This would be done at monitoring locations that yielded the strongest odors and H_2S concentrations during Phase 1 using the combination of methods described in Section 3.1.3. Odors may be caused largely by H_2S and related reduced-sulfur compounds, in addition to a wide variety of other compounds like aldehydes and organic acids. While H_2S and several related compounds may be detected by the analyses described in Section 3.1.3, determining the actual air composition and relative concentrations is important to outlining any needed additional effective and targeted mitigation measures for future odor control.

Air sampling needs to be conducted after at least some monitoring has taken place, as outlined in Section 3.1.3, to ensure that a representative set of samples containing adequately odorous air are collected. Two levels of air sampling are proposed, as described in Sections 3.2.2 and 3.2.3 below.

It is assumed that automated monitoring using the OdaLog or similar instrumentation, as described in the Section 3.1.3, will be continued during Phase 2.

3.2.1 Proposed Sample Collection Procedure

Locations from which air samples are to be collected for odor analysis are to be determined based on the results of Phase 1 sampling, and additionally, the use of a simple device like a Jerome Analyzer to determine specific high-odor locations at which samples will be collected. The recommended method of collecting air samples for odor analysis is to use a flux hood whose function is to isolate the headspace directly above a given surface. Plastic tubing is connected into the sampling hood to retrieve the air sample. The hood is necessary to eliminate the otherwise significant effects of wind or outside air diluting the sample. Where the hood is used to collect samples from the surface of the cooling or settling ponds, a floatable inner tube is contained within it to collect the sample. Where sampling is to be conducted from LAA sites, the hood may be directly placed on the surface.

3.2.2 Odor Panel Detection Threshold (DT) and Characterization by EN13725

Measurements of "total odor" of a given air sample is provided by odor panel testing. This procedure would enable BC to estimate the composition of odorous air. In odor panel testing, a sample is diluted below its human detection limit and introduced into a gas delivery system that conveys air through cones that the odor panel uses to sniff a stream containing the diluted sample and a stream of odor-free air. The panel consists of twelve trained individuals that participate in a series of trials in which each participant attempts to differentiate the diluted sample (delivered through one cone) from the carbon filtered, odor-free air (delivered through two separate cones). During each trial, each panelist is asked to identify which cone delivered the odorous sample. The test administrator increases the sample concentration in the gas delivery system until at least half of the odor panel correctly identifies the odorous sample. At that point, the test ends. The number of successive rounds of concentrating the sample represents how "detectable" the odor is (more required concentrations of the diluted sample indicate a less detectable odor).

The same odor panel will provide a subjective characterization of the odor, which includes the use of descriptive words such as "vegetable", "medicinal", "offensive", etc. This characterization often helps to identify the primary compounds that are contributing to the detected odor by the panel. Additionally, the panel will provide a value of hedonic tone for the air sample, which is a subjective measurement of offensiveness of the sample. A hedonic tone of -10 represents the most offensive odor the panelist has ever smelled and a hedonic tone of +10 represents the most pleasant odor the panelist has ever smelled.

Air samples collected for testing by an odor panel may be collected in a vacuum chamber using 10-L Tedlar bags. The headspace is isolated during collection using a sampling hood.

BC recommends three samples are collected at each of the OdaLog locations and two samples at each on-site monitoring location where odors have been detected. Samples at each location should be taken at different time points to identify any variation throughout the day. An additional benefit of the sample collection and odor panel analysis is that the results can be directly applied to calibration of a potential future Odowatch system, as described in Section 3.4.

3.2.3 Reduced Sulfur Compounds by ASTM D5504

This method would be used to determine the relative quantities of potential sulfur-containing odorous compounds, and may be changed based on the results of the odor panel analysis described above. Most reduced sulfur compounds (RSCs) have a very low human detection threshold concentration (the minimum concentration of the compound required for the average nose to detect its presence). For example, the detection threshold of H_2S is 0.5 ppbv and the detection threshold of the reduced sulfur organic compound methyl mercaptan (CH_3SH) is 1.1 ppbv. Reduced sulfur organic compounds are frequently described as smelling like rotten vegetables and garbage. The RSC test (ASTM D5504) may be run using Gas Chromatography equipped with a Mass Spectrometer (GC/MS) at a commercial lab.

Air samples to be tested using this method are to be collected in a vacuum chamber using 1-L Tedlar bags. The headspace should be isolated using a sampling hood as described in Section 3.2.1.

One RSC sample would be taken at each location identified for the ODT samples described above.

3.3 Summary of Recommended 2016 Monitoring

Table 3-1 presents a summary of proposed measurements and samples outlined in this odor monitoring plan.

Table 3-1. Summary of Proposed Measurements and Samples for Odor Monitoring

Sampling/Monitoring Location	Monitoring (Phase 1)		Sampling (Phase 2)	
	Field H_2S/ Nasal Ranger[1,5]	Automated H_2S Monitoring[2]	Odor Panel[3] (Phase 2)	RSCs[4] (Phase 2)
Valley Ranch Southeast (off-site)	Weekly			
Crawford and Zumwalt (off-site)	Weekly			
Chevron Central (off-site)	Weekly			
MS2/MS3 (on-site)	Weekly	OdaLog w/cell modem	3	1
Abel/Husted (on-site)	Weekly		2	1
SE Corner of MS11 (on-site)	Weekly	Standard OdaLog	3	1
Old 99 (on-site)	Weekly		2	1
MS16 (on-site)	Weekly		2	1
Cooling and Settling Ponds	Weekly			

1. *Using Jerome 605 Analyzer (value indicates number of samples) and NasalRanger™*
2. *Using OdaLog Data Loggers*
3. *Samples collected in 10-L Tedlar bags (value indicates number of samples)*
4. *Reduced sulfur compounds samples collected using sampler hoods at specified locations; this accounts for one sample collected at each of up to five locations.*
5. *Samples collected at two different times of the day (proposed morning and afternoon)*

3.4 Phase 3: Potential 2017 Odor Monitoring

If mitigation measures taken for the 2016 season do not adequately mitigate potential nuisance odors, an automated composite air sampler could be considered as recommended by Regional Board staff. The OdoWatch eNose system developed by OdoTech is a candidate for such monitoring. The system uses real-time sensor arrays, in combination with weather monitoring and air plume modeling, to determine the rough constitution of an air sample and forecast odor occurrences based on past data trends. Experience has shown that the use of an Odowatch with their eNose sensor would require substantial calibration to be able to discern tomato wastewater related odors from background agricultural odors. Using its odor dispersion model, the Odowatch system does provide a means for determining odor issues potentially occurring in the community before they are detected by the public.

Section 4: Odor Emission Mitigation Measures

Potential mitigation measures to prevent odors in the vicinity of the Morning Star plant are recommended and detailed in this section. The measures described in this section are categorized by treatment system and are based on our assumptions of potential odor impacts, as summarized in Section 1.4. Ideally, these measures would be implemented prior to the 2016 season and, if necessary, during Phase 1 of the odor monitoring plan outlined in Section 3. The Phase 1 monitoring would enable pinpointing the major sources and locations of odor issues within the facility and addressing them using one or more of the measures described in this section. It must be noted that the odor control measures recommended here are not exhaustive, and more practical measures outside this scope (some of which may already have been implemented by Morning Star) may also be considered in tandem with the odor monitoring plan. Additionally, these measures are intended to be proactive, to prevent odors, and not reactive, in response to odor complaints.

4.1 Odor Mitigation Measures Targeting Cooling and Settling Ponds

Due to the high vacuum and temperature in the final condenser loop, the water discharged to the cooling pond likely has inherently low DO. This could have been exacerbated by increased BOD and microbial oxygen demand due to the plumbing issues associated with the new evaporators. The plumbing issues were resolved by September 2015.

Maintaining a DO level over 1.0 mg/L in the cooling pond is required in the 2013 WDRs. It may be advisable to provide means for supplemental aeration for the cooling pond for the 2016 season. This is discussed in detail in a separate TM on the cooling pond and settling pond.

Additional control measures to address potential odors from the settling pond were recommended by Board staff, including the installation of dissolved air flotation units and pre-screening to remove solids input into the settling pond. Both these options involve the addition of substantial infrastructure, and may only be necessary if other measures fail to maintain acceptable surface layer DO levels.

It is understood that Morning Star already uses a supplemental oxidizing agent (ADOX 750 - sodium chlorite) occasionally for unpredictable upsets, and this practice may be continued if deemed necessary. Morning Star could use ADOX or other oxidizing agents as necessary for mitigating odors in case of an unexpected upset or other conditions.

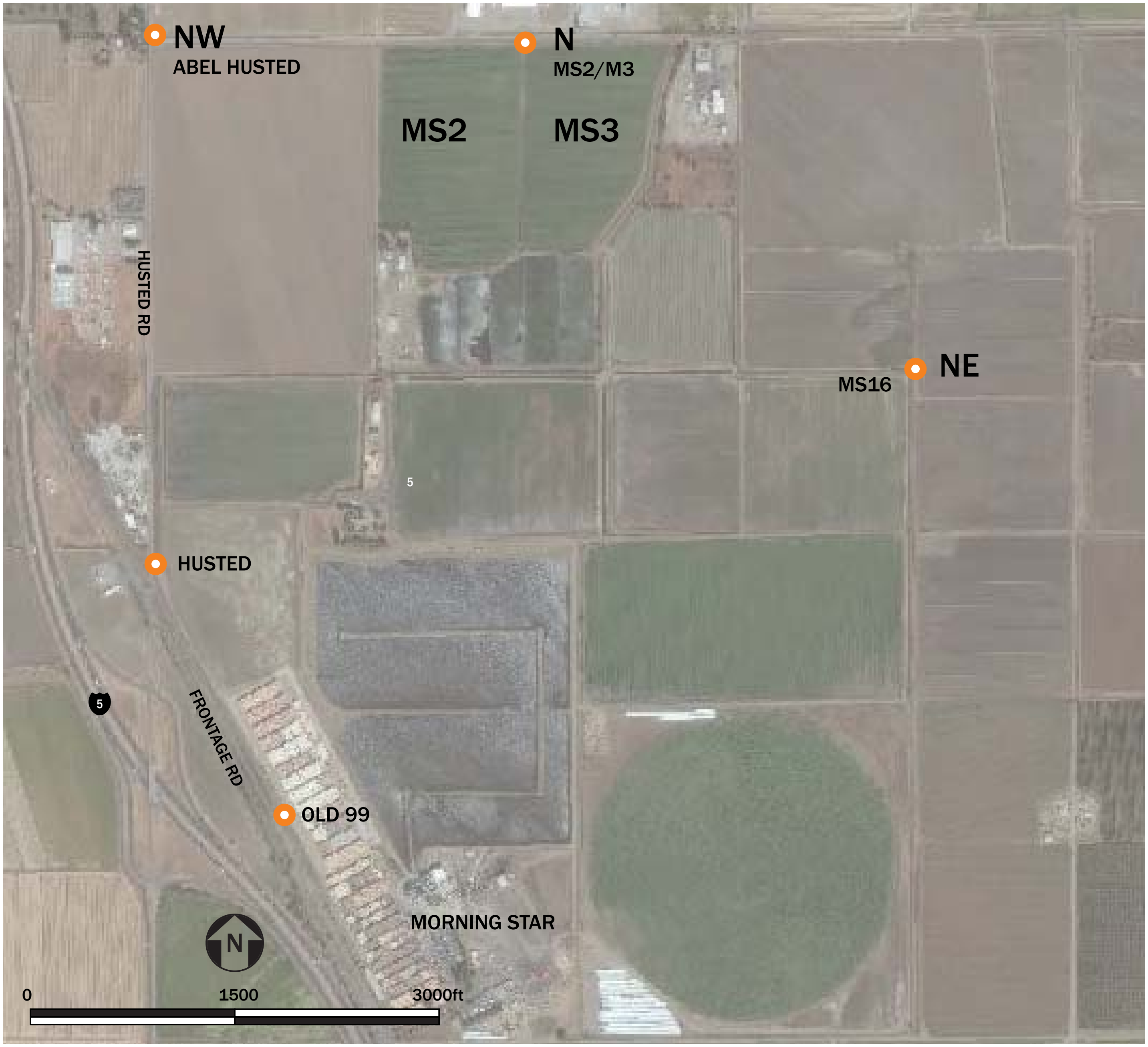
4.2 Odor Mitigation Measures Targeting the LAA

Odor control targeting the LAA involves ensuring aerobic conditions in the distribution system, fields, and soil surface, as well as even distribution of organic loadings and suspended solids over the crop area. The prediction of wastewater BOD, as proposed in the TM on Loading Rates, using the brix correlation, will help the operators direct the applications and needed cycle times to avoid odor–producing conditions.

The primary recommended measure is the installation of sprinkler systems to suitable fields to provide better oxygen transfer to the upper soil and more even distribution of wastewater. Morning Star has already installed a center pivot sprinkler system in field MS24, and may consider center pivot, side roll and other sprinkler systems to other fields that are suitably configured for sprinkler irrigation. Sprinkler irrigation may also allow application of wastewater to additional areas more easily.

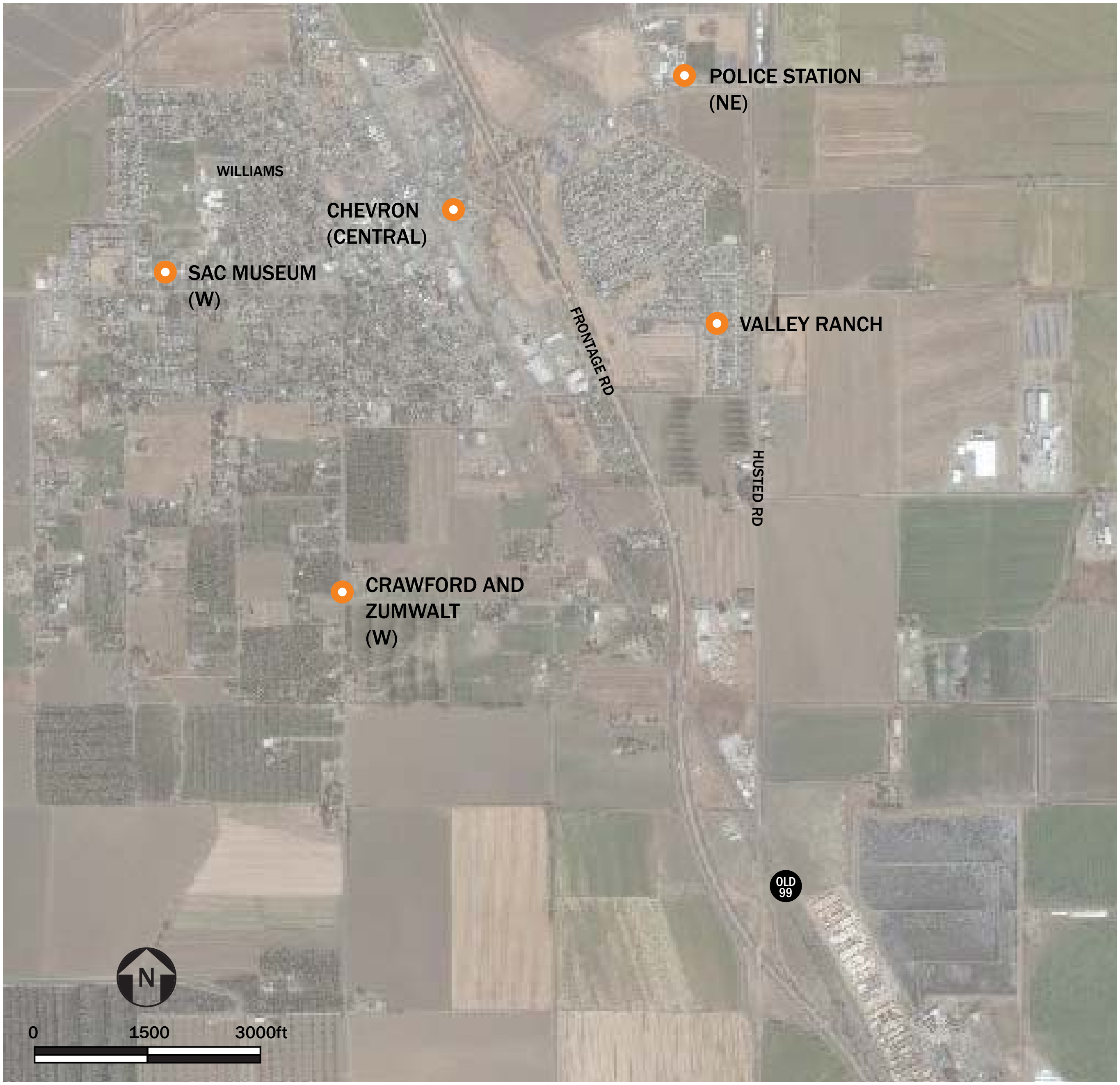
Problems with startup of the expanded production facilities in 2015 also resulted in a significant amount of larger tomato solids not being captured ahead of the settling pond and LAA. Should solids screening and settling pond improvements implemented for the 2016 season not be sufficiently effective for solids removal, additional fine screens or dissolved air flotation could be considered in future years.

Figures



Map Source: 2013 TerraServer, Digital Globe

DATE	PROJECT	SITE	
Jan. 2016	148680	Morning Star CDO Response	Figure 2-1
Brown AND Caldwell		TITLE: Map of Onsite Odor Reporting Locations	



Map Source: 2013 TerraServer, Digital Globe

DATE	PROJECT	SITE	
Jan. 2016	148680	Morning Star CDO Response	Figure 2-2
Brown AND Caldwell		TITLE Map of Offsite Odor Reporting Locations	