CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL VALLEY REGION
CLEANUP AND ABATEMENT ORDER R5-2017-0703

FOR
FORWARD INC. AND REPUBLIC SERVICES, INC.
FORWARD LANDFILL
SAN JOAQUIN COUNTY

This Order is issued to Forward, Inc. and Republic Services, Inc. (hereafter jointly referred to as Discharger) based on provisions of California Water Code sections 13304 and 13267, which authorize the Executive Officer of the California Regional Water Quality Control Board, Central Valley Region (hereafter Central Valley Water Board) to issue a Cleanup and Abatement Order (2017 Order) and to require the submittal of technical reports.

1. Forward Inc., a subsidiary of Republic Services Inc., owns and operates the Forward Landfill (facility) which is about seven miles southeast of Stockton. The facility is a municipal solid waste (MSW) landfill.

2. In 1973, the Discharger began operating the original Forward Landfill, which was 157 acres in size. In 2000, the Discharger purchased the adjacent Austin Road Sanitary Landfill which was 410 acres in size. The Discharger combined the two operations into a single 567 acre parcel known as Forward Landfill. As a result of this consolidation, the Austin Road Landfill became the North Unit of the Forward Landfill. In this Order, the North Unit will be referred to as the Austin Road Unit.

3. The Forward Landfill, including the Austin Road Unit, is regulated under Waste Discharge Requirements (WDRs) Order R5-2014-0006 (for the landfill operation) and Order R5-20030080 (for the land application of treated groundwater to "recharge basins"). The landfill consists of both unlined and lined waste management units (WMUs). The current permitted footprint is approximately 388 acres, of which 288 acres contains WMUs. The original Austin Road Unit footprint is 123.9 acres. The Austin Road Unit does not contain an engineered liner, or a leachate collection and removal system, both of which are necessary to prevent the downward migration of pollution. The original Austin Road Unit is now overlain by lined units referred to as "Future Units 04 through 13". These Future Units are synthetically lined and contain leachate collection and removal systems.

4. Groundwater downgradient of the old Austin Road Unit is impacted with volatile organic compounds (VOCs), including dichloroethane, dichloroethylene, tetrachloroethylene, and trichloroethylene. VOCs were first detected in 1989. The Discharger's May 2014 Unsaturated Zone Monitoring Review states: "*Since 1998, groundwater impacts have been identified up to 4,000 feet downgradient (northeast) of the landfill and appears to have migrated to a lower depth at the leading edge of the plume".*

5. On 8 December 2008 the Executive Officer issued Cleanup and Abatement Order R5-2008-0714 (2008 CAO). The 2008 CAO required the Discharger to define the lateral and vertical extent of groundwater impacts downgradient of the landfill, provide an alternate source of drinking water to any landowner with a municipal or domestic well that had a confirmed detection of VOCs, implement source control to prevent VOCs from migrating past the landfill point of compliance, enhance the Facility's landfill gas and groundwater monitoring programs, and submit quarterly progress reports.

6. The Discharger began its efforts to comply with the 2008 CAO by addressing the requirement to provide replacement water for the California Youth Authority facility. This was done by extending

the City of Stockton's drinking water supply line to the facility. The Discharger also began supplying replacement water to two households near the landfill. The Discharger implemented an evaluation monitoring program in which numerous wells were installed; however, none of the wells were at the downgradient edge of the plume, nor did the Discharger continuously monitor these wells. With regard to source control and remedial actions, the Discharger installed an additional groundwater extraction well and multiple landfill gas extraction wells between 2008 and 2011. Even with these efforts, the release of these pollutants is still ongoing, and the Discharger has not adequately defined the plume vertically and laterally. The plume continues to migrate past the Point of Compliance, defined below, and is potentially impacting other domestic wells, which were previously thought to be outside of the plume.

7. This Order rescinds the 2008 CAO except for enforcement purposes.

8. Monitoring Specification G.4 of the WDRs states, "*The concentrations of the constituents of concern in water passing the Point of Compliance (defined pursuant to Title 27, section 20164 as a vertical surface located at the hydraulically downgradient limit of the landfill unit that extends through the upper most aquifer underlying the unit) shall not exceed the concentration limits established pursuant to MRP No. R5-2014-0006*." The MRP establishes the following monitoring locations as the point of compliance:

Cell or Module	Point of Compliance Monitoring Wells
Old Forward Units	MW-1, -2, -3, -10, -13, -14, -15, -16, -17, -18, -19, -21.
Austin Road Unit	AMW-1, -4, -6, -7.

The MRP states that the concentration limit for VOCs is non-detect. Therefore, the detection of any VOCs, in any monitoring well that is at the landfill's point of compliance or beyond, is a violation of Standard Prohibition C.6 which states: "*The discharge of waste constituents to the unsaturated zone or to groundwater is prohibited*."

9. This 2017 Order summarizes the Discharger's efforts to date to define the vertical and lateral extent of the release from the landfill, as well as the installation of corrective action systems to control and capture the migration of contaminates. Despite these efforts, the Discharger has been unsuccessful in containing and cleaning up the VOC plume. Therefore, this 2017 Order requires additional investigation to fully delineate the vertical and lateral extent of the plume and the installation of enhanced corrective action measures such that no VOCs will be present in the groundwater beyond the landfill boundaries. With regard to treatment of the extracted groundwater, the Discharger has consistently violated the VOC effluent limit. Therefore, this Order requires the Discharger to enhance its groundwater treatment system. This Order also requires the Discharger to address violations associated with over-loading of nitrogen to the cannery waste land application area.

SURFACE WATER AND GROUNDWATER CONDITIONS

10. The Forward Landfill is on the floor of the northern San Joaquin Valley. Surface water drainage from the northern half of the site is to the North Fork of South Littlejohns Creek; drainage from the southern half flows to the South Fork of South Littlejohns Creek thence to Littlejohns Creek in the Duck-Littlejohns Hydrologic Area (31.40) of the San Joaquin River Basin.

11. The Water Quality Control Plan, Fourth Edition, for the Sacramento River Basin and the San Joaquin River Basin (hereafter Basin Plan), designates beneficial uses, establishes water quality

objectives, and contains implementation plans and policies for all waters of the Basin. The designated beneficial uses of Littlejohns Creek as specified in the Basin Plan, are municipal and domestic supply; agricultural supply; water contact recreation; non-contact water recreation; commercial and sport fishing; warm fresh water habitat; cold freshwater habitat; wildlife habitat; preservation of biological habitats of special significance; migration of aquatic organisms; and spawning, reproduction, and/or early development.

12. The designated beneficial uses of the groundwater, as specified in the Basin Plan, are domestic and municipal supply, agricultural supply, industrial service supply, and industrial process supply.

13. The WDRs state there are 35 known domestic, industrial, or agricultural groundwater supply wells within one mile of the facility.

14. According to the 2014 WDRs, the direction of groundwater flow is generally toward the north-northeast. The estimated average groundwater gradient is approximately 0.002 feet per foot. The estimated average groundwater velocity is 195 feet per year. However, since 2011 the Discharger has periodically documented a south, south-west groundwater flow direction beneath the southern half of the facility. This change in groundwater flow direction may be the result of increased pumping of nearby agricultural wells.

15. According to the 2014 WDRs, the first encountered groundwater is about 60 to 80 feet below the native ground surface. Groundwater elevations range from -20 feet mean sea level (MSL) to -30 feet MSL. The groundwater is unconfined. The depth to groundwater fluctuates seasonally by as much as 10 feet.

16. Nearby land uses include agricultural lands to the east, west, and south of the landfill. The O.H. Close Youth Correctional Facility is approximately 1,900 feet north of the Austin Road unit. In 2012, the Department of Corrections constructed a 100 acre hospital facility adjacent to the Youth Correctional Facility. The Stockton Municipal Airport is approximately one mile west of the landfill. One mile northeast of the facility is the Burlington Northern and Santa Fe Railroad Intermodal facility. There is a residence on Austin Road that is 500 feet from the entrance to Austin Road unit. There are also two residences on Lynch Road, approximately 0.5 miles southeast of the site. An additional ten residences are located on along Newcastle Road. All of these residences utilize groundwater for domestic and agricultural supply, and this Order requires the Discharger to sample the domestic wells to determine if they have been impacted by the release from the landfill.

GROUNDWATER RELEASE

17. The original 123 acre Austin Road Unit was filled by the City of Stockton using the trench method. Trenches were excavated to approximately 20 feet below ground surface and then backfilled with waste. Unlike modern landfills, the trenches did not contain a leachate collection and removal system or a protective bottom liner. Therefore, there is no engineered barrier to prevent the downward migration of landfill leachate or gas from the original 123 acre Austin Road unit.

18. Significant VOC groundwater impacts including, but not limited to, 1,1-dichloroethane, cis-1,2-dichloroethylene, tetrachloroethylene (PCE), and trichloroethylene (TCE), are associated with the Austin Road Unit. Impacts were initially detected in 1989. A corrective action plan was approved in 1991. The plan consisted of a load checking program, extraction and treatment of impacted

groundwater from two wells, and continued monitoring of the effectiveness of corrective action. However, by 1998 it was clear that the plan was insufficient to remediate the groundwater impacts because the same VOCs were still detected in downgradient monitoring wells.

19. In 2002, after several years of revisions and the Board's issuance of a 2001 Time Schedule Order, the Discharger submitted a Revised Engineering Feasibility Study (EFS) which Board staff approved. The EFS proposed to use an artificial recharge basin[1] as a means to mitigate groundwater impacts, and projected that VOCs in groundwater would be below one microgram per liter (µg/l) after nine years of using the recharge basin. The EFS included the following items:

    a. Enhance landfill gas control system to prevent further release of VOCs from the landfill;
    b. Continue groundwater extraction and treatment with the existing two extraction wells;
    c. Implement a groundwater artificial recharge system using treated water;
    d. Install additional groundwater monitoring wells to monitor the effectiveness of the corrective action and determine the need for modifications; and
    e. Install an interim cover on Austin Road Landfill Unit 1.

20. The Discharger stated in its 2002 Joint Technical Document that "*the VOC polluted groundwater extends approximately 4,000 feet northeast from the northern border of the existing Austin Road Landfill. The plume appears to have migrated to a lower depth at the leading edge of the plume. The primary contaminants of concern are tetrachloroethylene and trichloroethene, with concentrations levels up to 59 and 48 micrograms per liter, respectively. The highest VOC concentrations are present within a sand layer that extends beneath the site between approximately 80 to 104 feet below ground surface*."

21. In 2003, the Central Valley Water Board adopted WDRs Orders R5-2003-0049 and R52003-0080 to implement the revised remedial actions. At that time, the Discharger extracted groundwater from extraction wells EW-1 and EW-2, which are adjacent to the northern boundary of the Austin Road Unit. The extracted groundwater was pumped through an air stripper to remove VOCs, and then discharged to the recharge basin. For the fourth quarter of 2007, the two wells extracted an average rate of 209 gallons per minute or 301,000 gallons per day.

22. On 24 April 2007 the California Department of Health Services issued Citation No. 03-1007C-004 to the California Department of Corrections for its O.H. Close Youth Correctional Facility because the drinking water supplied to inmates exceeded the 5 ug/L maximum contaminant level (MCL) for tetrachloroethylene. The source of the VOCs was attributed to the Austin Road Unit. As stated above, the 2008 Order required that the Discharger provide an alternate source of drinking water to the correctional facility; this was accomplished. In addition, replacement water has been supplied to residents at 7898 and 8106 Austin Road.

23. In accordance with the 2008 Order, the Discharger installed two additional groundwater extraction wells and increased landfill gas extraction as a means of VOC source control. In addition, the 2008 Order required the Discharger to install an evaluation monitoring well network. To meet this requirement, the Discharger installed 24 groundwater monitoring wells between 2008 and 2011; however five of the wells were subsequently destroyed as part of the Department of Corrections facility expansion. Unfortunately, the Discharger did not collect samples from all the monitoring wells until the second quarter of 2014. At this time, VOCs were detected in monitoring well AMW-24R approximately 6,500 feet downgradient (north east) of the Austin Road Unit. Because the

[1] The recharge basin is 12 acres in size, excavated to a depth of 12 feet below grade, at which the extracted, treated, groundwater is disposed of.

extent of the plume has not been defined, this 2017 Order requires the installation of additional groundwater monitoring wells.

24. Figure 4 of the Discharger's 15 July 2016 *Corrective Action Evaluation Report* shows that the plume is continuing to migrate northward from the old Austin Road Unit and now covers an area exceeding 858 acres. The 2016 second quarter groundwater sampling event found that monitoring well AMW-1, at the point of compliance, had a total VOC concentration of 38 ug/L indicating that the release is still uncontrolled in this area.

25. The 2016 second quarter groundwater sampling data also confirms that the lateral extent of the plume still has not been defined or controlled. For example, monitoring well AMW25 and AMW 26R (see Attachment A), are over 4,000 feet downgradient of the site with reported total VOC concentrations at 0.56 and 10.78 ug/L, respectively. There are no wells downgradient of these wells; consequently the lateral extent of the plume is undefined. The depth and migration of the plume was modelled by the Discharger in the 13 July 2013 *Groundwater Model Simulations for Engineering Feasibility Study*. The model isolated four unique layers of Tertiary sediments. The vadose zone, which is the first zone, accounts for the upper 80 feet of material. The next two model zones are described as intercalated coarse sands and gravels with a 30-foot clay barrier that is discontinuous. These two zones account for 105-feet of sediments. The deep zone is characterized as "several hundred feet thick consisting of coarse-grained sediments with fine grained lenses". The deepest well that VOCs have been detected in was the Youth Correctional Facility's Supply Well 3 screened to a depth of 505–feet below ground surface, which is in the fourth zone. There are no deeper wells in the network to demonstrate that the vertical extent of the plume has been defined.

26. As shown in the table below, data presented by the Discharger in the Second Quarter 2016 Groundwater Monitoring Report shows that 21 of the 39 wells downgradient of the landfill exceed the VOC concentration limit of "non-detect." A map that illustrates the location of the monitoring wells is included as Attachment B of this Order.

Total VOC Concentrations Reported from May 2016 Groundwater Sampling Event

Well ID	Total VOCs, ug/L	Well ID	Total VOCs, ug/L
AMW-1	38	AMW-24R	3.51
AMW-2	<.5	AMW-24SR	<.5
AMW-4	<.5	AMW-25	.56
AMW-5R	<.5	AMW-26R	10.78
AMW-6	2.20	AMW-28	<.5
AMW-7	<.5	AMW-29	8.60
AMW-10	<.5	AMW-29S	<.5
AMW-11	<.5	AMW-30	<.5
AMW-12	<.5	AMW-30S	<.5
AMW-13	15	AMW-31	2.80
AMW-13B	4.41	AMW-31S	4.12
AMW-14	<.5	AMW-32	<.5
AMW-18	<.5	AMW-32S	<.5
AMW-18B	3.96	AMW-31	2.80
AMW-19	18	AMW-31S	4.12
AMW-19BR	20	AMW-32	<.5
AMW-21	17.40	AMW-32S	<.5

Well ID	Well ID	Well ID	Total VOCs, ug/L
AMW-21S	6.65	7898-A	1.91
AMW-22	17.33	8106-A	8.77
AMW-22S	71.80		

CURRENT CORRECTIVE ACTION SYSTEM

27. As stated in the above Findings, the Discharger has implemented corrective actions to address groundwater impacts at the Facility. Current corrective actions include (a) operating a landfill gas extraction system and (b) operating a groundwater extraction system, which includes four groundwater extraction wells located along the north boundary of the Austin Road Unit. Following extraction, VOC impacted groundwater is treated utilizing an air stripper which discharges the treated groundwater to the recharge basin.

Landfill Gas Extraction System

28. The landfill gas collection and destruction system at the Austin Road Unit (ARU) and the overlying Forward Future Units is comprised of approximately 164 landfill gas extraction wells, as of January 2017. While approximately 129 wells recover landfill gas from the upper portion of the Austin Road Unit (known as the Future Units) approximately 35 wells, as of January 2017, recover landfill gas from the entire 123 acres of the unlined Austin Road Unit. This is problematic because the Discharger has previously identified the unlined ARU as the source of VOCs in the groundwater downgradient of the site[2]. According to the Discharger, the gas extraction system is continuously monitored, adjusted and balanced to enhance gas extraction from the Facility. This Order requires the Discharger to install additional landfill gas monitoring devices along the point of compliance and if necessary and if necessary install additional landfill gas extraction wells within the unlined portion of the Austin Road Unit such that the monitoring network can demonstrate that there is a negative pressure throughout the entire unit (i.e., landfill gas is not leaving the unit). The unlined Austin Road Unit will be considered to be demonstrating negative pressure when all active landfill gas extraction wells indicate negative pressure (i.e. under active vacuum) and no VOCs are detected at the point of compliance as determined by quarterly gas system monitoring.

29. Because the Austin Road Unit has no engineered bottom liner and the nearest unsaturated zone monitoring devices are approximately 300 to 1,600 feet from the edge of the unit. The Discharger will need to install an unsaturated zone monitoring network (i.e., gas monitoring devices) to evaluate the effectiveness of the landfill gas extraction system currently installed within the Austin Road Unit. Because of the distance to the existing boundary gas monitoring points, this network shall be placed along the point of compliance to assure compliance with the WDRs Standard Prohibition C.6, which states: "*The discharge of waste constituents to the unsaturated zone or to groundwater is prohibited*".

30. Extracted landfill gas is conveyed through the collection system to the waste-to-energy plant and to the landfill gas flaring system. Based on data provided in the 2015 Annual Monitoring Report, the waste-to-energy plant and landfill gas flaring system has additional capacity to manage increased

[2] In response to a draft of this Order, the Discharger stated that the unlined Austin Road Unit is significantly smaller in waste mass and significantly older than the remaining lined area units of the landfill, and therefore, may not contribute the majority of the LFG generation. Extracting the LFG from the upper waste mass with LFG extraction wells, as Forward currently is, aids in preventing LFG migration down into the older waste mass.

gas flows[3] This Order requires the Discharger to review the existing gas extraction system within the unlined Austin Road Unit, and enhance the gas extraction as warranted from within the unlined Austin Road Unit. If the point of compliance gas monitoring wells have detections of VOCs, then this Order requires the Discharger to take corrective action, which is anticipated to be the installation of additional gas extraction wells**.**

Groundwater Extraction System

31. Groundwater extraction rates during 2016 ranged from 142-206 gallons per minute (gpm) for the four groundwater extraction wells (EW-1 through EW-4) located along the northern boundary/point of compliance of the Austin Road Unit[2]. Historical groundwater sampling results from downgradient wells indicate that the current groundwater extraction system is not (a) controlling the ongoing release of VOCs from migrating beyond the point of compliance; (b) preventing the VOC plume from migrating further downgradient; (c) overcoming the artificial draw created by the nearby pumping wells; or (d) restoring the beneficial uses of the aquifer in all zones affected by the release. Therefore, this Order requires the Discharger to enhance the groundwater extraction and treatment system such that the beneficial uses are restored within a specified timeframe.

32. Following extraction, the impacted groundwater is treated utilizing an air stripper. The air stripper was reportedly designed to treat up to 305 gpm. However, in 2015 and 2016, the effluent from the system ranged between 110 and 206 gpm (consistent with the volume of extracted groundwater entering the system). This Order requires the Discharger to enhance the remedial system (i.e. groundwater extraction system) in order to remediate the plume.

33. The effluent discharged from the treatment system is piped to a 12 acre recharge basin north of the Austin Road Unit. As stated in Finding 3 of this Order, this discharge of effluent from the treatment system is regulated under Order R5-2003-0080.

34. Order R5-2003-0080 requires the Discharger to treat extracted groundwater containing VOCs prior to discharging the water into the facility's recharge basin. Treatment of the extracted groundwater is considered complete when VOCs are no longer detected in the effluent. However, review of the first, second, and third quarter 2016 monitoring reports show that VOCs, specifically 1,4-dichlorobenzene, cis-1,2 dichloroethene, PCE and TCE, had been detected in the effluent. The total VOC concentration ranged from a low of 0.13 ppb on 29 February 2016 to a maximum of 1.19 ppb on 31 August 2016. The detections of VOCs in the treated effluent are a violation of Facility Specification B.4. of Order R5-2003-0080, which states, "*Treated effluent discharged to the infiltration gallery shall have non-detect levels of VOCs using EPA 8260 analysis."* This Order requires the Discharger enhance the groundwater treatment such that no VOCs are detected in the effluent.

35. The intent of the recharge basin was to create an artificial mound, thus creating a barrier to prevent further migration of the plume. The Discharger's 2016 *Annual Corrective Action Evaluation Report* states: "*In past Annual Corrective Action Evaluation Reports, these projected isoconcentration maps were compared to maps based on contemporary data, collected from the same monitoring wells utilized in modeling. However, the EFS simulations projected that none of the modeled VOCs would be detected above 1 µg/L after nine years of recharge. Use of the*

[3] According to the Discharger, this increased flow would be sufficient to "accommodate the estimated yearly increase in landfill gas flow rate that is anticipated to be generated through the additional yearly placement of waste."

recharge basin was initiated in May 2003, and the May 2016 results therefore correspond to approximately 13 years after initiation of the recharge basin." Although VOCs have been reduced locally (in the vicinity of the recharge basin) the application of effluent groundwater on the migration of the plume has shown little contribution to aquifer restoration.

36. The continued detections of VOCs in groundwater indicate that current corrective actions are not sufficient and must be enhanced. Additionally, the migration of VOCs further downgradient indicates that the corrective action systems in place are not providing sufficient source control to stop VOCs from migrating past the point of compliance. Therefore, this Order requires the Discharger to revisit the need for water replacement of nearby wells; enhance the landfill gas collection system in the unlined portion of the Austin Road Unit; install additional groundwater extraction wells to remediate the plume; and enhance the groundwater treatment system.

RESPONSE TO CONTINUING RELEASE

37. Staff's review of the Discharger's 2015 Annual Monitoring Report determined that groundwater has been, and continues to be, affected by a release of pollutants from the Facility, in violation of the WDRs. On 27 June 2016, the Assistant Executive Officer issued a Water Code Section 13267 Order (see Attachment C to this Order) which required the Discharger to comply with Title 27 by submitting an *Interim Corrective Action Measures Plan* and a *Corrective Action Monitoring and Evaluation Monitoring Workplan* to address the groundwater impacts and define the lateral and vertical extent of the off-site groundwater impacts.

38. On 15 September 2016, the Discharger submitted its response to the 13267 Order (Attachment D), stating "*Forward recognizes the continued exceedances of water quality protection standards (WQPS), including VOCs and inorganic constituents in various wells at the Forward Landfill, and understands that these exceedances represent a violation of the WDRs."*

39. On 15 September 2016, the Discharger also submitted an updated *Evaluation Monitoring and Corrective Action Monitoring Work Plan* (see Attachment E to this Order) to address the release. In Attachments D and E, the Discharger has proposed an initial phase of field work that includes (1) rebalancing the existing groundwater extraction system by reducing pumping in two wells to account for the addition of a new well; (2) installing eight groundwater monitoring wells for plume definition; (3) installing 13 landfill gas wells into the unlined portion of the Austin Road Unit, and (4) installing an additional groundwater extraction well along the Point of Compliance. The proposed work is limited in scope, therefore this Order requires the Discharger to implement its proposal, as well as to:

- Resample domestic water wells that could be impacted by the release, and provide replacement water to any affected domestic well.
- Install a landfill gas corrective action monitoring network at the point of compliance (edge of waste management unit) around the Austin Road Unit, and if gas is detected leaving the Unit, then enhance the landfill gas extraction system.
- Define the entire vertical and lateral extent of the groundwater plume
- Enhance the groundwater extraction system to capture the entire plume, or install other equivalent (or better) corrective action measures.

- Enhance or upgrade the existing groundwater treatment system to comply with Facility Specification B.4. of Order R5-2003-0080.

NITROGEN MASS LOADING LIMIT VIOLATIONS

40. Discharge Specification B.10 of Order R5-2014-0006, states in part *"The annual total nitrogen load shall not exceed 300 pounds per acre, unless a site specific loading rate is established by a Nutrient Management Plan approved by the Executive Officer."* The *Discharge Specification also states: "At the end of the waste application season, the total mass of nitrogen applied per acre shall be calculated and a crop shall be planted, grown, and harvested that will remove 100% of the total mass of nitrogen applied over the season. Failure to remove by cropping 100% of the total mass of nitrogen applied is a violation of this Order."*

41. In addition to land applying cannery waste, Order R5-2014-0006 allows the Discharger to discharge cannery rinsate water to the Class II surface impoundments or compost facility. Excess cannery residual material (solids) may also be discharged and treated at the compost facility.

42. During 2014, the Discharger applied 434 pounds per acre (lbs/ac) of total nitrogen to the cannery waste land application area, in violation of the WDRs limit of 300 lb/ac total nitrogen. The Discharger planted winter wheat to remove the nitrogen. However, winter wheat typically takes between 140 to 200 lb./acre nitrogen[3]. Therefore, the Discharger also violated the WDR requirement that the crop must remove 100% of the applied nitrogen.

43. The Discharger subsequently submitted a Nutrient Management Plan for the land application area on 21 May 2015. The plan concluded that an increased nitrogen loading rate above 300 lbs/ac was justified as no groundwater impacts were observed and the total nitrogen measured in the soil following cannery waste application and cropping was less than the values measured before cannery waste application. However, the plan did not propose a specific loading rate for the land application area. Therefore, the 300 lb/ac total nitrogen loading rate specified in the WDRs remained in effect.

44. For 2015, the Discharger reported that it applied 476 lb/ac of total nitrogen to the cannery land application area, in violation of the WDRs limit of 300 lb/ac total nitrogen. The Discharger planted winter wheat to remove the nitrogen. However, winter wheat typically takes between 140 to 200 lb./acre nitrogen[4]. Therefore, the Discharger also violated the WDR requirement that the crop must remove 100% of the applied nitrogen

45. In response to the 2015 Nitrogen Management Plan and violations of the WDR limits on 27 June 2016, the Assistant Executive Officer issued a Water Code Section 13267 Order for Technical Reports, and required the Discharger to submit a *Cannery Waste Land Application Area Compliance Plan* and a *Nutrient Management Plan* to address nitrogen loading exceedances.

46. The Discharger's *Cannery Waste Land Application Area Compliance Plan* includes a proposal to implement two cropping cycles, instead of the current single crop (planted after the cannery season is over). The plan also proposed to dispose of excess cannery waste in alternate disposal locations if the Discharger anticipates exceeding the nitrogen loading limit. While the WDRs do allow the Discharger to dispose of cannery waste in alternate locations (under specific criteria),

[4] Table 6-7 from *Manual of Good Practice for Land Application of Food Processing/Rinse Water*, February 2007. Kennedy Jenks Consultants and www.cdfa.ca.gov/go/FREPguide.

Board staff cannot accept this proposal because it is appears physically impossible for the Discharger to grow two dry-land crops in the period between cannery waste applications. The Discharger tried to do this in 2015-2016 but was unable to do so.

47. The Discharger also submitted a 5 August 2016 *Nutrient Management Plan* which states that the 300 lbs/acre nitrogen limit is "arbitrary" and therefore requests that the loading limit be increased to 476 lbs/acre. The plan concluded that an increased nitrogen loading rate above 300 lbs/ac was justified as no groundwater impacts were observed and the total nitrogen measured in the soil following cannery waste application and cropping was less than the values measured before cannery waste application. However, staff cannot approve this request because the Discharger has not demonstrated how it will also comply with the remainder of the requirements found in Discharge Specification B.10, in particular that the crop must remove 100% of the nitrogen applied. Staff are unaware of any dry-land crop, planted between November and May of each year, that can remove this much nitrogen

48. The WDRs required that the Discharger submit a *Water Quality Protection Standards Report* for the cannery waste area. The Discharger submitted the report but used non-standard statistical methods because there were not enough data (only 5 sample sets) to use acceptable statistics, which typically require a minimum of 8 data points. The Discharger also included an outlier data point without an explanation. This Order requires the Discharger to submit an updated report using all data since 2005, statistics that comply with Title 27, and to remove the outlier point unless it provides justification for its inclusion.

49. This Order requires that the Discharger comply with all aspects of Waste Discharge Specification B.10. In addition, the Discharger is required to notify staff immediately upon reaching the 300 lb/ac nitrogen limit, enhance its reporting in order to fully demonstrate compliance, and to update the Water Quality Protection Standards for the cannery waste area.

REGULATORY CONSIDERATIONS

50. Analytical data shows that the Discharger did not comply with the 2008 CAO, as the groundwater plume has not been fully defined and the current corrective action systems are not capable of fully capturing or remediating the contamination. Groundwater quality data and flow direction measurements provided by the Discharger indicate that the groundwater treatment system is undersized and unable to prevent the migration of the VOC plume.

51. The release of wastes to groundwater, and the application of nitrogen to cropland at rates exceeding the loading limit, are violations of the WDRs and Title 27

52. The Discharger's data indicate that the on-going release from the Facility has impacted the beneficial uses of the aquifer downgradient of the landfill property.

53. The Discharger has caused or permitted waste to be discharged or deposited where it has discharged to waters of the state and has created, and continues to threaten to create, a condition of pollution or nuisance.

54. The State Water Resources Control Board (hereafter State Water Board) has adopted Resolution No. 92-49, the *Policies and Procedures for Investigation and Cleanup and Abatement of Discharges under Water Code Section 13304*. This Policy sets forth the policies and procedures

to be used during an investigation or cleanup of a polluted site and requires that cleanup levels be consistent with State Water Board Resolution No. 68-16, the *Statement of Policy with Respect to Maintaining High Quality of Waters in California*. Resolution No. 92-49 and the Basin Plan establish the cleanup levels to be achieved. Resolution No. 92-49 requires the groundwater contaminants to be cleaned up to background, or if that is not reasonable, to an alternative level that is the most stringent level that is economically and technologically feasible in accordance with California Code of Regulations, title 23, section 2550.4. Any alternative cleanup level to background must (1) be consistent with the maximum benefit to the people of the state; (2) not unreasonably affect present and anticipated beneficial use of such water; and (3) not result in water quality less than that prescribed in the Basin Plan and applicable Water Quality Control Plans and Policies of the State Board.

55. Chapter IV of the Basin Plan contains the *Policy for Investigation and Cleanup of Contaminated Sites*, which describes the Central Valley Water Board's policy for managing contaminated sites. This policy is based on CWC Sections 13000 and 13304, California Code of Regulations, title 27, division 2, subdivision 1, and State Board Resolution Nos. 6816 and 92-49. The policy addresses site investigation, source removal or containment, information required to be submitted for consideration in establishing cleanup levels, and the bases for establishment of soil and groundwater cleanup levels.

56. CWC section 13304(c)(1) provides that: *"Any person who has discharged or discharges waste into waters of this state in violation of any waste discharge requirements or other order or prohibition issued by a Regional Water Board or the state board, or who has caused or permitted, causes or permits, or threatens to cause or permit any waste to be discharged or deposited where it is, or probably will be, discharged into the waters of the state and creates, or threatens to create, a condition of pollution or nuisance, shall upon order of the Regional Water Board clean up the waste or abate the effects of the waste, or, in the case of threatened pollution or nuisance, take other necessary remedial action, including but not limited to, overseeing cleanup and abatement efforts. A cleanup and abatement order issued by the state board or a Regional Water Board may require the provision of, or payment for, uninterrupted replacement water service, which may include wellhead treatment, to each affected public water supplier or private well owner.* [emphasis added] *Upon failure of any person to comply with the cleanup or abatement order, the Attorney General, at the request of the board, shall petition the superior court for that county for the issuance of an injunction requiring the person to comply with the order. In the suit, the court shall have jurisdiction to grant a prohibitory or mandatory injunction, either preliminary or permanent, as the facts may warrant."*

57. CWC section 13267(b) provides that: "*In conducting an investigation specified in subdivision (a), the Regional Water Board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste outside of its region that could affect the quality of waters of the state within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the Regional Water Board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports"*

58. The technical reports required by this Order are necessary to assure compliance with this Order and the WDRs, and to protect the waters of the state. Existing data and information about the site indicates that waste has been discharged or may continue to be discharged at the property, which

is currently owned and operated by the Discharger named in this Order.

59. The issuance of this Order is an enforcement action taken by a regulatory agency and is exempt from the provisions of the California Environmental Quality Act (CEQA) (Pub. Resources Code, section 21000 et seq.), pursuant to California Code of Regulations, title 14, section 15321(a)(2). The implementation of this Order is also an action to assure the restoration of the environment and is exempt from the provisions of the CEQA in accordance with California Code of Regulations, title 14 sections 15307 and 15308. This Order may also be classified as a minor action to prevent, minimize, stabilize, mitigate or eliminate the release or threat of release of hazardous waste or substances, and is exempt from the provisions of CEQA in accordance with California Code of Regulations, title 14 section 15330.

60. Any person aggrieved by this action of the Central Valley Water Board may petition the State Water Board to review the action in accordance with CWC section 13320 and California Code of Regulations, title 23, sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., 30 days after the date of this Order, except that if the thirtieth day following the date of this Order falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day. Copies of the law and regulations applicable to filing petitions may be found on the Internet at: http://www.waterboards.ca.gov/public_notices/petitions/water_quality or will be provided upon request.

IT IS HEREBY ORDERED THAT, Cleanup and Abatement Order R5-2008-0714 is rescinded except for enforcement purposes, and that pursuant to CWC sections 13267 and 13304, Forward Inc. and Republic Services, Inc., its agents, successors, and assigns, shall investigate the discharges of waste to groundwater, clean up the waste, and abate the effects of the waste, forthwith, resulting from the operations at the Forward Landfill. The Discharger shall continue to comply with WDRs Orders R5-2003-0080 and R5-2014-0006.

1) Water Supply (Public Health)

a) By **1 June 2017,** the Discharger shall submit an update to its 17 April 2008 *Domestic Well Sampling Plan* to identify and sample[5] all domestic and municipal wells that are located within the area bounded by Highway 99 to the west, South Jack Tone Road to the east, 2,500 feet north of Arch Road, and south to the South Fork of South Little John's Creek. Sampling shall be completed without any cost to the landowners or purveyors. The Plan must include the items listed in Item 2c (i-iv) of Cleanup and Abatement Order R5-2008-

b) 0714. No later than **1 July 2017**, the Discharger shall begin implementing the plan and sample all domestic and municipal drinking water wells, subject to the landowners' and/or purveyor's consent.

b) By **1 December 2017** the Discharger shall submit a report of sampling results to Central Valley Water Board, the landowner/well user, and to the San Joaquin County Environmental Health Department. This report shall include a description of the sampling activities, the geographic position of each well (latitude and longitude coordinates obtained with a handheld GPS unit is acceptable), the well completion report (if available and not confidential), whether

[5] The Discharger shall take all reasonable steps to identify and sample wells. If necessary, Water Board staff will assist with obtaining well logs. If well owners refuse to allow the Discharger access to sample their well(s), then the Discharger shall note this fact in its Well Sampling Report.

or not supplemental water has been provided, and documentation that the owners received the data for their well with an explanation of the results. The wells listed in the updated *Domestic Well Sampling Plan* shall continue to be sampled on a semi-annual basis unless Water Board staff agrees in writing that there is no need to sample a specific well (e.g., if a well is outside the plume or poorly constructed). Semi-annual monitoring reports shall be submitted by **1 May and 1 November** of each year, and shall contain the information listed in this paragraph**.**

2) Source Control (Landfill Gas)

a) **Effective immediately**, the Discharger shall continuously[5] operate the Austin Road Unit's landfill gas extraction system except for periodic and required maintenance, The Discharger shall optimize all remedial systems, as needed, to maintain negative pressure within the waste mass of the unlined Austin Road Unit.

b) By **1 May 2017,** the Discharger shall submit a *Point of Compliance*[6] *Monitoring Network Installation Work Plan* to install a monitoring network that surrounds the north, west and south limits of the Austin Road Unit at the unit boundary that complies with §20415d.2d of Title 27. The goal of the network is to determine whether or not the current gas extraction system is preventing gas from entering the vadose zone. The minimum spacing of each installed probe shall not exceed 1,000 feet between points. All probes to be installed shall be installed with the following three distinct probes set at the following intervals:

i) Interval One: The top of the screen interval[6] is set at the base elevation of the unlined Austin Road Unit.

ii) Interval Two: The top of the screen interval is set in the zone of highest air permeability between the interval one and the third interval.

iii) Interval Three: The top of the screen interval is set above the highest groundwater elevation since groundwater monitoring was initiated at this site.

d) By **1 December 2017**, the Discharger shall submit a *Point of Compliance Monitoring Network Installation Report* which certifies installation and operation of the point of compliance monitoring probes outlined in Item 2b of this Order.

[5] 24 hours a day, 365 days a year

[6] The screen length shall not exceed five feet.

[6] The Point of Compliance as defined for this Order shall be the vertical surface located at the edge of the waste management unit that extends through the uppermost aquifer underlying the unit.

e) Beginning with the fourth quarter 2017, the Discharger shall initiate gas monitoring of the vadose zone. All new point of compliance monitoring probes shall be added to the monitoring network and sampled quarterly for gas pressure and gas concentrations (methane, carbon dioxide, oxygen and remainder/balance gas) in Table 6 of Monitoring and Reporting Program R5-2014-0006. Each probe interval shall be sampled annually for TO-15 beginning in 2017, if either methane concentrations exceed 1 percent or total organic vapors exceed 10 ppbv. Results of the quarterly monitoring network sampling shall be submitted quarterly in the *Corrective Action Program Update.*

f) Upon adoption of this Order, the requirement listed in Table VI, "Landfill Gas Monitoring Program" in Monitoring and Reporting No. R5-2014-0006, requiring sampling of all landfill gas extraction wells for volatile organic compounds by EPA method TO-15 on a semi-annual basis will be suspended. All other monitoring requirements listed in Table VI remain unchanged.

g) Beginning **1 March 2018**, if VOCs are detected in the point of compliance monitoring probes, then within 90 days, the Discharger shall submit a *Landfill Gas Extraction System Optimization Report*. The report shall be based on monitoring results from the point of compliance monitoring probes The report shall evaluate the effectiveness of the gas extraction system in preventing VOCs from entering the vadose zone beneath the entire footprint of the 123 acre unlined Austin Road landfill. If the report finds that VOCs are entering the vadose zone, then the report shall include a work plan and proposed time schedule to install additional gas extraction wells. The report shall also describe any steps necessary to modify the physical components or operating elements of the existing landfill gas extraction system to prevent VOCs from entering the vadose zone

3) <u>Interim Groundwater Plume Definition and Remediation – North of the Landfill</u>

a) By **1 July 2017**, the Discharger shall begin installing the Phase I and Phase II monitoring wells (AMW-23R, 23S, 33, 33S, 34, 34S, 35 and 35S), as outlined in Attachment E of this Order. These wells shall be become a part of the well network and shall be monitored in accordance with the monitoring schedule in the MRP. The first sampling of these wells shall be during the Third Quarter 2017 and the results included in the Third Quarter 2017 monitoring report.

b) By **1 November 2017**, the Discharger shall submit a *North Side Monitoring Well Installation Report*, which certifies the installation of monitoring wells AMW-23R, 23S, 33, 33S, 34, 34S, 35 and 35S and contains the information listed in the second section of Attachment F.

c) By **1 July 2017**, the Discharger shall submit an *Interim Groundwater Plume Remediation System Workplan*, which proposes the installation of additional groundwater extraction wells to remediate areas north of the landfill where the Discharger identified total VOC concentrations in groundwater exceeding 25 µg/l (as shown on Attachment B of this Order). The extraction wells shall be located near the center of plume mass and must be able to contain and treat the VOCs, create an inward gradient of the groundwater table, measured from existing monitoring wells within the plume, in all zones affected by the release. The workplan must include: a) the number and location of wells to be installed, b) the information listed in the first section of Attachment F, c) extraction rate for each well, and d) a treatment and discharge plan for the extracted groundwater. In addition, the work plan shall propose a monitoring plan for this system which will demonstrate the areal radius of influence for each pumping well and the volume of groundwater pumped from each well.

d) By **1 November 2017**, the Discharger shall submit an *Interim Groundwater Plume Remediation System Installation Report* that certifies the installation and continuous operation of the additional groundwater extraction wells. Once installed, the extraction wells shall be monitored weekly for flow. The data shall be included with the quarterly groundwater monitoring reports required by Order R5-2014-0006, beginning with the 2017 third quarter groundwater monitoring report.

4) Groundwater Plume Definition – West of the Landfill

a) By **1 May 2017**, the Discharger shall submit a *West Side Monitoring Well Installation Workplan* to define the lateral and vertical extent of the plume for the area west of Newcastle Road. The work plan shall include a step out criteria during the drilling program. Although domestic wells cannot be used as monitoring wells for purposes of plume delineation, data from these wells may be incorporated into the overall characterization of the plume. The work plan shall propose the location and depth for each additional groundwater monitoring well, and contain the items in Section 1 of Attachment F. All new wells shall become part of the well network and shall be monitored in accordance with the groundwater monitoring requirements in MRP R5-2014-0006.

b) By **1 November 2017**, the Discharger shall submit a *West Side Monitoring Well Installation Report of Results* for all newly installed monitoring points installed west of the landfill. The report shall include the information listed in the second section of Attachment F.

5) Final Definition and Remedial Action of the Groundwater Plume

a) **Effective immediately**, the Discharger shall operate the existing groundwater extraction system, or any upgraded or replaced corrective action system, continuously[7] until the groundwater plume is remediated to comply with concentration limits within the WDRs. No groundwater monitoring or extraction well may be removed without approval from the Assistant Executive Officer.

b) By **1 August 2017**, if the Discharger wishes to propose in-situ remediation, then the Discharger shall submit a preliminary plan and schedule for implementing a pilot study to evaluate the effectiveness of in-situ remediation for groundwater impacted by VOCs.

c) By **1 December 2019**, the Discharger shall submit a *Groundwater Plume Investigation Report* that includes a *Revised Engineering Feasibility Study.* The combined reports shall include the following:

i) A detailed evaluation of the lateral and vertical extent of VOCs in the vadose zone and groundwater that extends in all directions from the Austin Road Unit. If analytical data shows a VOC detection for any of the groundwater zones, then the report shall propose additional locations and depths for monitoring wells to define the extent of groundwater impacts.

ii) A revised site conceptual model that defines the stratigraphy, hydrogeologic properties of the shallow and deep aquifer zones; influence of water supply wells and on-site disposal of treated groundwater on groundwater elevation and gradient under current site conditions.

[7] 24 hours a day, 365 days a year operation except for periodic and required maintenance or unpreventable equipment failure

iii) a proposal for a remedial action capable of stopping further migration of VOC impacted groundwater beyond the point of compliance, as well as restoring the beneficial uses of groundwater in all zones affected by the release for the entire plume no later than **1 July 2023**. If in-situ remedial techniques are proposed, then submit a Notice of Intent for Order R5-2015-0012, Waste Discharge Requirements General Order for In-Situ Remediation and Discharge of Treated Groundwater to Land. The Notice of Intent's contingency plan must be adding additional groundwater extraction wells.

iv) a certification that the corrective action monitoring system is in compliance with California Code of Regulations, title 27, section 20415(b)(1)(D), and has the ability to evaluate the operational performance of the entire corrective action remediation system(s). If the system is deficient in any zone affected by the release, then a proposal to enhance the corrective action monitoring network to demonstrate compliance with the WDRs.

6) Corrective Action Program Notification

a) The Discharger shall notify the Central Valley Water Board within 24 hours of any unscheduled shutdown of any remediation system(s) that lasts longer than 48 hours. This notification shall include the cause of the shutdown and the corrective action taken (or proposed to be taken) to restart the system. Any interruptions in the operation of the remediation system(s), other than for maintenance, emergencies, or equipment failure, without prior approval from Central Valley Water Board staff or without notifying the Central Valley Water Board, within the specified time is a violation of this Order.

b) The Discharger shall notify Central Valley Water Board staff at least three working days prior to any onsite work, testing, or sampling that pertains to environmental remediation and investigation and is not routine monitoring, maintenance, or inspection.

7) Nitrogen Loading

a) Unless a different limit is approved per the process in the WDRs, **Effective immediately**, the Discharger shall comply with all aspects of Discharge Specification B.10 of the 2014 WDRs, including (a) the nitrogen loading limit of 300 pounds/acre total nitrogen on the cannery waste land application area and (b) the requirement to "remove by cropping 100% of the total mass of nitrogen applied."

b) As cannery waste is applied to the land application area, the Discharger shall keep a running total of the pounds of nitrogen applied per acre, and shall immediately inform Board staff when 300 pounds nitrogen/acre (or other limit as allowed by the WDRs)has been applied. At that point, no more cannery waste may be applied to the land application area.

c) The Annual Land Application Monitoring Summary, required by the MRP, shall include a map of the land application areas identifying the approximate tonnage applied to each application area, soil sampling locations and daily field logs that clearly document the Discharger's evaluation of each item described in Section A.8 of the MRP. The report shall also clearly document how the Discharger determined the pounds of nitrogen applied per acre, and how it determined what crop was appropriate to remove the entire amount of nitrogen applied. The

Summary shall also contain daily logs that show that the Discharger complied with the BMPs listed in Discharge Specification B.8, and shall contain summary table(s) with all analytical data collected during the year.

d) By **1 March 2018**, the Discharger shall submit an updated *Cannery Waste Water Quality Protection Report* using all monitoring data collected since 2005. The report shall follow the requirements in WDRs Provision H.G.8, and the statistical method used shall comply with Title 27. The 17 November 2014 value of 180 mg/l total nitrogen in well AMW-10 shall not be used in the calculation unless the Discharger can demonstrate that it is not an outlier. The Discharger shall evaluate whether data from additional existing or new groundwater monitoring wells are necessary to determine whether the application of cannery waste has the potential to impact water quality.

8) Groundwater Extraction System Effluent

a) **Effective immediately**, the effluent discharged from the current or any future groundwater treatment system must comply with the Facility Specification B.4 of WDR Order R5-2003-*0080 which states: "Treated effluent discharged to the infiltration gallery shall have non-detect levels of VOCs using EPA Method 8260 analysis."*

b) By **1 June 2017**, the Discharger shall submit a *Groundwater Extraction System Report* which includes:

i) Operations and Maintenance Plan that includes a maintenance schedule for maintaining the optimal efficiency of the treatment system.

ii) A proposed monitoring plan, sampling schedule, and reporting frequency that will provide timely results to assure continuous compliance with WDR Order R5-20030080.

9) Corrective Action Program Update

a) **Beginning with the first quarter following adoption of this Order,** the Discharger shall submit *Quarterly Corrective Action Program Updates.* These reports shall be submitted by the **15th day of the month following the quarter for which the report is prepared** (e.g., the 2017 third quarter summary report is due on **15 October 2017).** The reports shall describe all work completed during the previous calendar quarter to comply with this Cleanup and Abatement Order and describe any violations of this Order. The report shall include information about the remediation system: total hours of operation of all remediation systems/day (estimated for holidays and weekends); the exact time of any system failure and restart; a description of any repairs; an evaluation of the performance of each individual extraction point (both landfill gas and groundwater); the volume of water discharged from the system; the flow (in gallons) from each well on a daily basis; total flow rate of landfill gas removed by the gas extraction system, and the mass of contaminants removed by the groundwater extraction system.

The Discharger shall obtain all local and state permits and access agreements necessary to fulfill the requirements of this Order. The Discharger shall continue any remediation or monitoring activities until such time as the Executive Officer determines that sufficient cleanup has been accomplished to fully comply with this Order and this Order has been rescinded.

In accordance with California Business and Professions Code sections 6735, 7835, and 7835.1, engineering and geologic evaluations and judgments shall be performed by or under the direction of registered professionals competent and proficient in the fields pertinent to the required activities. All technical reports specified herein that contain workplans, that describe the conduct of investigations and studies, or that contain technical conclusions and recommendations concerning engineering and geology shall be prepared by or under the direction of appropriately qualified professional(s), even if not explicitly stated. Each technical report submitted by the Discharger shall contain the professional's signature and/or stamp of the seal.

Each report submitted to the Central Valley Water Board shall be included in the Discharger's Operating Record. Furthermore, any person signing a document submitted under this Order shall make the following certification:

"*I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my knowledge and on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment*."

If the Discharger fails to comply with the provisions of this Order, the Central Valley Water Board may refer this matter to the Attorney General for judicial enforcement or the Assistant Executive Officer may issue a complaint for administrative civil liability. Failure to comply with this Order may result in the assessment of administrative civil liability up to $10,000 per violation per day, pursuant to the Water Code sections 13268, 13350, and/or 13385. The Central Valley Water Board reserves its right to take any enforcement actions authorized by law.

Any person aggrieved by this action of the Central Valley Water Board may petition the State Water Board to review the action in accordance with Water Code section 13320 and California Code of Regulations, title 23, sections 2050 and following. The State Water Board must receive the petition by 5:00 p.m., 30 days after the date of this Order, except that if the thirtieth day following the date of this Order falls on a Saturday, Sunday, or state holiday, the petition must be received by the State Water Board by 5:00 p.m. on the next business day. Copies of the law and regulations applicable to filing petitions may be found on the Internet at: http://www.waterboards.ca.gov/public_notices/petitions/water_quality or will be provided upon request.

This Order is effective upon the date of signature.

-Original Signed By-

PAMELA C. CREEDON, Executive Officer

10 April 2017

Date

Enclosures: next page

Enclosures: Attachment A: Monitoring Points
Attachment B: Total VOC Plume Map
Attachment C: 27 June 13267 Order
Attachment D: Discharger's Response to 27 June 13267 Order
Attachment E: Updated Evaluation Monitoring and Corrective Action Monitoring Workplan
Attachment F: Requirements for Monitoring Well Installation Workplans

BK/HH/WW: 3/24/17

ATTACHMENT A

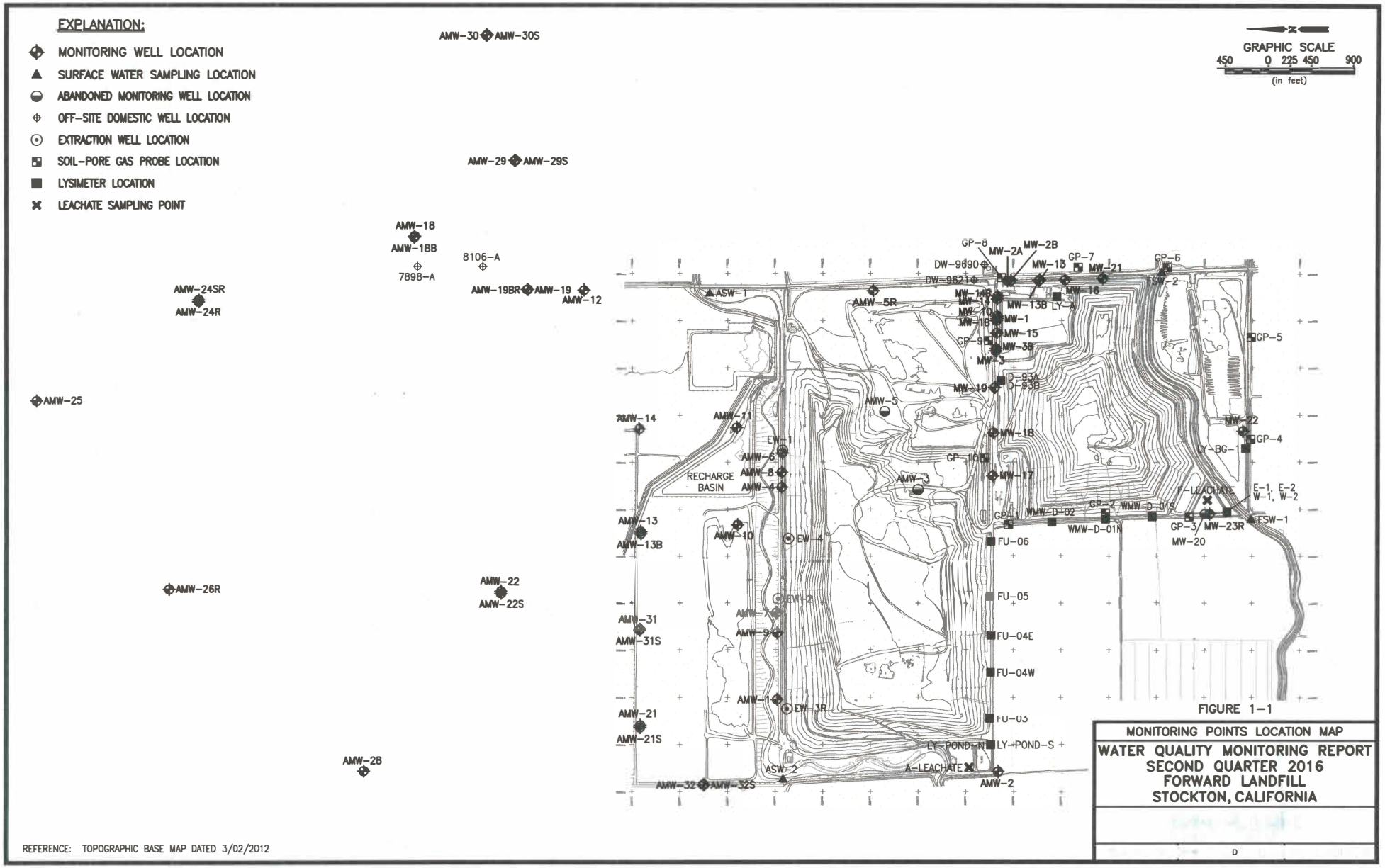


FIGURE 1-1

MONITORING POINTS LOCATION MAP
WATER QUALITY MONITORING REPORT
SECOND QUARTER 2016
FORWARD LANDFILL
STOCKTON, CALIFORNIA

REFERENCE: TOPOGRAPHIC BASE MAP DATED 3/02/2012

D

Water Quality Monitoring Report 2nd Quarter 2016, Geo Logic Associates

ATTACHMENT B

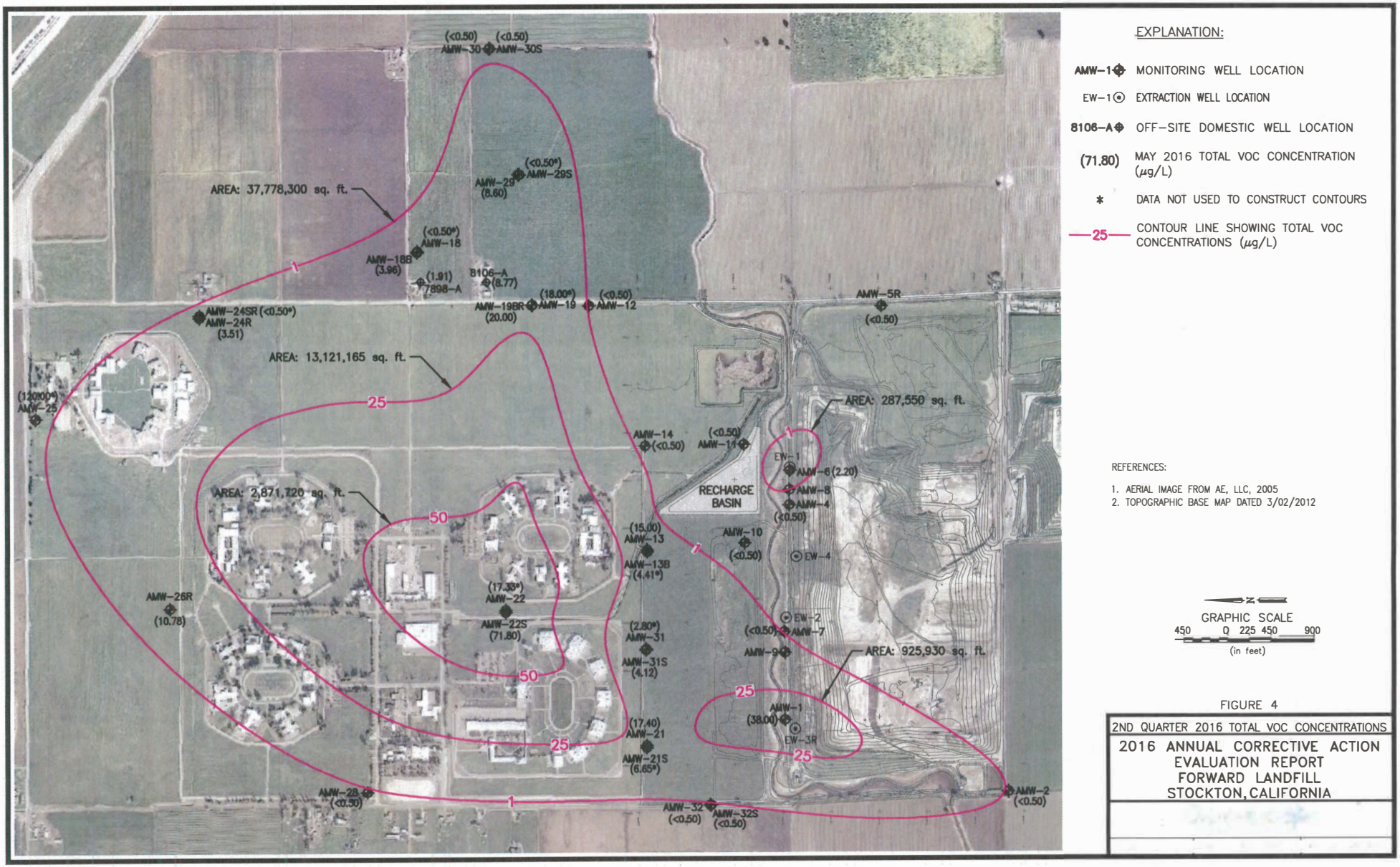


FIGURE 4

2ND QUARTER 2016 TOTAL VOC CONCENTRATIONS

2016 ANNUAL CORRECTIVE ACTION EVALUATION REPORT FORWARD LANDFILL STOCKTON, CALIFORNIA

2016 Annual Corrective Action Evaluation Report, Geo Logic Associates

ATTACHMENT C

27 June 2016

Joe Lipka
Environmental Manager
Republic Services
9999 South Austin Road
Manteca, CA 95336

CERTIFIED MAIL
91 7199 9991 7035 8419 8797

WATER CODE SECTION 13267 ORDER FOR TECHNICAL REPORTS, FORWARD LANDFILL, SAN JOAQUIN COUNTY

The disposal of solid waste at the Forward Landfill in San Joaquin County is regulated by Waste Discharger Requirements (WDRs) Order R5-2014-0006 and Cleanup and Abatement Order R5-2008-0714. Republic Services (Discharger) owns and operates the facility.

Regional Board staff has reviewed the *2015 Annual Monitoring Report*. As detailed in the enclosed *Monitoring Report Compliance Checklist*, staff has identified multiple violations of the WDRs. These violations include:

- Incomplete/inadequate monitoring of the landfill and compost facility;
- Exceedences of the nitrogen loading limit to the cannery waste land application area;
- Exceedences of the water quality protection standards in several of the groundwater monitoring wells;
- Submittal of an incomplete monitoring report;

To address these violations, this Order requires Republic Services to submit the following reports.

1. A report stating how Republic Services will ensure that all future monitoring reports are submitted on time and complete.
2. A *Leachate Monitoring Report*.
3. A *Cannery Waste Land Application Area Compliance Plan* to address nitrogen loading exceedences to the cannery waste land application area.
4. An *Interim Corrective Action Measures Plan* to address violations of the water quality protection standards.
5. An *Updated Evaluation Monitoring Program Workplan* to evaluate the current extent of groundwater impacts caused by the release of waste constituents from the landfill.

Monitoring and Reporting Violations of the WDRs:
Monitoring and Reporting Program (MRP) Order R5-2014-0006 requires the Discharger to test each leachate collection and removal system (LCRS) for each waste management unit annually and submit the results in the annual monitoring report. The exclusion of annual LCRS testing for Waste Management Units A, D and FU is a violation of Section A.3 of the MRP and

Provision H.3 of the WDRs, which states, *"The Discharger shall comply with MRP No. R5-2014-0006, which is incorporated into and made part of this Order by reference."* Therefore, Republic Services must test the LCRS for the waste management units A, D, and FU and submit the results.

WDRs Order R5-2014-0006 limits the total annual nitrogen loading limit for the cannery waste land application area to 300 pounds per acre. The application of 476 pounds per acre of Nitrogen in 2015 is a violation of Discharge Specification B. 10 of Order R5-2014-0006, which states *"The annual total nitrogen load shall not exceed 300 pounds per acre, unless a site specific loading rate is established by a Nutrient Management Plan approved by the Executive Officer."* Therefore, Republic Services must submit a *Cannery Waste Land Application Area Compliance Plan* that describes the actions Republic Services will implement to comply with the land application area nutrient limits in the WDRs until a Nutrient Management Plan as described in the WDRs is submitted and approved by the Executive Officer.

MRP R5-2014-0006 requires the Discharger to collect and analyze a sample of leachate from the compost facility retention basin annually. The failure to collect and analyze a sample of leachate from the compost facility during 2015 is a violation of WDRs Specification C. 4. B. which states, *"The Discharger shall monitor leachate and water in the retention basin as required by MRP R5-2014-0006."* Therefore, Republic Services must ensure that the compost facility retention is sampled annually.

MRP Order R5-2014-0006 requires the Discharger to conduct weekly and monthly standard observations of the landfill for ponded water, exposed refuse, erosion, leachate seeps and receiving water impacts. These weekly observations are required to be reported quarterly. The exclusion of seep reporting observations and/or analytical data in the 2015 Annual Report is a violation of Standard Observations 6.D of the MRP and Provision H.3 of the WDRs, which states, *"The Discharger shall comply with MRP No. R5-2014-0006, which is incorporated into and made part of this Order by reference."*

The Discharger reported exceedances of the water quality protection standard during 2015 in groundwater detection monitoring wells AMW-6, MW-2, MW-3, MW-10, MW-13, MW-14, MW-16, MW-17, MW-18, MW-19, MW-23R and MW-24. These exceedences are a violation Monitoring Specification G. 4 of the WDRs which states, *"The concentrations of the constituents of concern in waters passing the Point of Compliance (defined pursuant to Title 27, section 20164 as a vertical surface located at the hydraulically downgradient limit of the landfill unit that extends through the uppermost aquifer underlying the unit) shall not exceed the concentration limits established pursuant to MRP No. R5-2014-0006."* Therefore, Republic Services must submit an *Interim Corrective Action Measures Plan* describing the actions that will be implemented within 60 days to prevent the ongoing, continuing release of contaminants to the underlying groundwater. Additionally, Republic must also submit an *Updated Evaluation Monitoring Workplan* to explain the steps that will be taken to completely and properly define define the lateral and vertical extent of groundwater impacts from the release.

Water Code Section 13267 Order for Technical Reports

Section 13267 of the California Water Code states, in part:

In conducting an investigation specified in subdivision (a), the regional board may require that

any person who has discharged, discharges, or is suspected of having discharged or discharging…waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports.

Section 13268 of the California Water Code states, in part:

(a) Any person failing or refusing to furnish technical or monitoring program reports as required by subdivision (b) of Section 13267…or falsifying and information provided therein, is guilty of a misdemeanor and may be liable civilly in accordance with subdivision (b). (b)(1) Civil liability may be administratively imposed by a regional board … in an amount which shall not exceed one thousand dollars ($1,000) for each day in which the violation occurs.

Republic Services failure to comply with the WDRs, MRP and Title 27 has prevented staff from being able to fully evaluate landfill operations, as well as the current horizontal and vertical extent of groundwater pollution caused by the release of waste from the landfill.

In order to evaluate landfill operations and ensure that the extent of groundwater impacts caused by the release of waste from the landfill is adequately defined and remediated, and to ensure compliance with the WDRs and applicable laws and regulations, Republic Services is hereby directed to submit the following reports. This request is made pursuant to Section 13267 of the California Water Code. Republic Services owns and operates the facility cited herein and is responsible for all waste disposed of at the facility and any associated groundwater/surface water impacts.

To address these violations, this Notice of Violation (NOV) requires Republic Services to submit the following reports.

1. By **5 August 2016,** submit a report stating how Republic Services will ensure that all future monitoring reports are submitted on time and complete.

2. By **5 August 2016**, submit a *Leachate Monitoring Report* with the leachate collection and recovery system test results for Waste Management Units A, D and FU.

3. By **5 August 2016**, submit a *Cannery Waste Land Application Area Compliance Plan* to address nitrogen loading exceedences to the cannery waste land application area. The plan shall describe the actions that will immediately be implemented to ensure that the nitrogen loading limit (300 lbs per acre) in the WDRs is not exceeded until a *Nutrient Management Plan* is submitted and approved by the Executive Officer.

4. By **15 August 2016**, submit an *Interim Corrective Action Measures Plan* to address violations of the water quality protection standards identified in detection monitoring wells. At a minimum, the plan should include immediate actions that can be taken to prevent further migration of the plume. (i.e. install additional landfill gas and groundwater extraction wells).

5. By **15 September 2016**, submit an *Updated Evaluation Monitoring and Corrective Action Monitoring Workplan* to define the lateral and vertical extent of groundwater impacts in all zones caused by the release of waste from the landfill. The *Workplan* shall propose and contain a plan and time schedule, to define the lateral and vertical extent of contamination in all groundwater zones affected by the release of waste. The extent of the plume is considered defined in each zone when inorganic constituents and VOCs are equal to or below the water quality protection standard in the WDRs. In addition to delineating the extent of the plume, the plan must include a groundwater monitoring well installation workplan that includes the items in the enclosed *Groundwater Monitoring Well Installation Workplan Requirements*, and must propose a schedule for installing additional groundwater monitoring wells to provide accurate, verifiable groundwater elevations and water quality data throughout all groundwater zones impacted by the release. In addition, the plan must address water quality in other wells adjacent to, or within the plume of contaminants. Therefore, a sufficient number of monitoring wells shall be proposed around the facility to ensure the that nearby water supply wells (domestic and agricultural) are not impacted by the release until groundwater cleanup is complete.

Any technical report required herein that involves planning, investigation, evaluation, engineering design, or other work requiring interpretation and proper application of engineering or geologic sciences shall be prepared by or under the direction of persons registered to practice in California pursuant to California Business and Professions Code sections 6735, 7835, and 7835.1. As required by these laws, completed technical reports must bear the signature(s) and seal(s) of the registered professional(s) in a manner such that all work can be clearly attributed to the professional responsible for the work.

Please be advised that failure to comply with these requirements may result in further enforcement action, including civil liabilities of up $1,000 per day for late or inadequate reports. In addition, Regional Board staff will continue to evaluate Republic Services compliance with its WDRs and the need for additional enforcement actions.

If you have any questions, or would like to meet to discuss the matter, please contact Brendan Kenny at (916) 464-4635 or at bkenny@waterboards.ca.gov.

Original Signed By

ANDREW ALTEVOGT
Assistant Executive Officer
Central Valley Regional Water Control Board, Sacramento

enclosures: Monitoring Report Compliance Checklist
Requirements for Monitoring Well Installation Workplans

cc: Robert Mc Clellon, San Joaquin County Public Health Department, Stockton
Marty Hartzell, Central Valley Regional Water Quality Control Board, Rancho Cordova

Attachment D

REPUBLIC SERVICES

Mr. Andrew Altevogt
Assistant Executive Officer
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670

15 August 2016

RE: Forward Landfill – Water Code Section 13267 Order for Technical Reports

Dear Mr. Altevogt:

Forward Inc. (Forward) is in receipt of your letter dated June 27, 2016 identifying violations of Waste Discharge Requirement Order Number R5-2014-0006 of the Monitoring and Reporting Program (MRP), identified by the California Regional Water Quality Board – Central Valley Region (RWQCB) in the 2015 Annual Monitoring Report. As stated in our letter dated July 19, 2016, Forward takes these violations seriously and makes every effort to comply with the regulatory requirements established by the WDRs. This letter is being submitted to identify interim corrective action measures that are being taken or will be taken to reduce constituent concentrations identified above a water quality protection standard (WQPS).

As presented in our Annual Report 2015, Forward recognizes continued (more than one time) exceedances of a WQPS including several VOCs in Forward Unit detection monitoring wells MW-16 and MW-17, and the inorganic constituent, bicarbonate, in well MW-18. Additional sporadic (one time during the year) exceedances of VOCs and/or inorganic constituents were reported in wells MW-2A, MW-3, MW-10, MW-13, MW-16, MW-17, MW-18, MW-23R and MW-24. For the Austin Unit, well AMW-6 is the only detection monitoring well exhibiting continued inorganic constituent exceedances. Well AMW-6 also contains several VOCs and based on its location next to corrective action extraction well EW-1, may be better identified as a corrective action well. Forward understands that these exceedances represent a violation of the WDRs. To address these exceedances in detection monitoring wells in particular. Forward is already in the process of implementing interim corrective actions in specific areas of the Forward Landfill. Additional interim corrective action measures are proposed to be completed within the next 60 days. The following sections outline these measures.

Rebalancing of the Corrective Action Pumping System

Based on the observed higher concentrations of VOCs in well AMW-1 on the west side of the site and AMW-6 on the east side of the site, Forward has increased the pumping rate and groundwater capture in the westernmost extraction well EW-3R and easternmost extraction well EW-1 while continuing to pump extraction wells EW-2 and EW-4 at lesser rates.

Connection of Additional Existing Landfill Gas Wells

Forward has identified a series of 8 inactive landfill gas wells located on the south side of the main access road (Forward Unit). Forward is in the process of configuring piping to connect these wells to the active landfill gas extraction system within the Austin Unit and expects these wells to be online within the next 60 days. An additional 13 landfill gas wells are proposed to be constructed within the Austin Unit in August and September 2016. Increased landfill gas extraction is expected to reduce VOC and some inorganic constituent concentrations in the surrounding groundwater.

Leachate Sump Pumping System Upgrades

Currently, the leachate sumps are pumped regularly, by moving from sump to sump with a mobile generator unit, and pumping for a designated period of time before moving to the next sump. Forward recognizes the need to upgrade the system (such as installing flow meters and liquid level devices) to more easily evaluate the quantity of liquid in each sump and better prioritize the locations for extended pumping and leachate removal. These upgrades are to be completed within the next 60 days. By optimizing the leachate pumping program, it is expected that leachate will be better managed, helping to reduce the occurrence of VOCs and inorganics in the underlying groundwater.

Construction of a Fifth Corrective Action Extraction Well

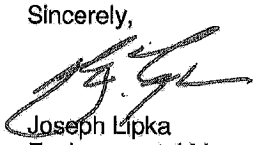
To further improve capture of groundwater along the point of compliance, Forward is preparing a bid package for the construction of an additional extraction well (EW-5), between EW-3R and EW-2. Once constructed and equipped with a pump, this well will be brought on line. As part of the updated Evaluation Monitoring Program and Corrective Actions Program, the five well pump and treat system (including EW-5) will be assessed for overall performance and effectiveness. Based on that evaluation, a second treatment unit and infiltration galley may be constructed in the near future to handle greater volumes of extracted groundwater.

Forward believes that these interim corrective action measures will improve the water quality in the vicinity of the Forward Landfill and reduce contributions to the existing groundwater plume. Forward is also working with its consultants to provide the RWQCB with an updated EMP and Corrective Action Workplan, due to the RWQCB on September 15, 2016, to fully characterize the vertical and lateral extent of the contaminant plume and present long-term corrective actions to address the water quality associated with the Forward Landfill.

In closing, and as stated above, Forward takes violations very seriously. Every effort is being made to implement measures that will improve the water quality and comply with Forward's WDRs. If you have questions or comments regarding the above information, please contact me at (209) 982-4298.

I certify under penalty of law, that I have personally examined and am familiar with the information submitted in this document and all attachments, and that based on my inquiry of those individuals immediately responsible for obtaining this information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Sincerely,



Joseph Lipka
Environmental Manager

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Geo-Logic
ASSOCIATES
Geologists, Hydrogeologists and Engineers

September 15, 2016
JN 2016-0007

Mr. Brendan Kenny
Engineering Geologist
Central Valley Regional Water Quality Control Board
11020 Sun Center Drive, Suite 200
Rancho Cordova, CA 95670

UPDATED EVALUATION MONITORING AND CORRECTIVE ACTION MONITORING WORKPLAN
FORWARD LANDFILL
SAN JOAQUIN COUNTY, CALIFORNIA

1.0 INTRODUCTION

This workplan has been prepared on behalf of Forward Incorporated (Forward), to the California Regional Water Quality Control Board – Central Valley Region (RWQCB) to provide information on the proposed drilling and construction of additional Evaluation Monitoring Program (EMP) wells for the Forward Landfill. The workplan and proposed EMP wells are intended to characterize the vertical and lateral limits of volatile organic compounds (VOCs) and inorganic constituents identified north of the Austin Road Unit (ARU) of the Forward Landfill and will supplement data from existing EMP wells at the site. The results of this evaluation will be used to develop an updated EMP or make recommendations for additional work to complete the EMP and subsequent Engineering Feasibility Study (EFS) for the Forward Landfill.

1.1 SITE DESCRIPTION

The Forward Landfill is located at 9999 South Austin Road in Manteca, California (Figure 1). The current Forward Landfill is owned by Forward, Inc. and is a combination of the Forward Landfill (Forward Unit) and the Austin Road Landfill (ARU). The combined site currently encompasses 567 acres, of which approximately 388 acres have been landfilled. The landfill property is located between two relatively minor drainages. The North Fork of Littlejohns Creek has been re-located adjacent to the northern boundary of the ARU of the Forward Landfill, and South Fork of Littlejohns Creek is located adjacent to the southern boundary of the Forward Unit (Figure 1). Both of these drainages are controlled by levees on both banks and flow to the west, discharging into the San Joaquin River. The surrounding property to the south, west, and east is primarily agricultural, while the California Department of Corrections and Rehabilitation Facility (CDCRF), formerly the Northern California Youth Center, is situated along the

northern border the Forward Landfill (Figure 1). The CDCRF is a 77-acre, intermediate, medical and mental health care facility for inmate-patients of the California Department of Corrections and Rehabilitation prison system.

As shown on Figure 1, the topography surrounding the site is relatively flat. Elevations adjacent to the landfill property range from about 35 to 45 feet above mean sea level (AMSL) and slope gently to the west. The existing waste fill rises to an elevation of over 200 feet AMSL above the adjacent terrain.

1.2 SITE GEOLOGY

The local geology consists of unconsolidated stream channel deposits (younger alluvium) comprised of clay, silt, sands, and gravels that extend from the ground surface up to 100 feet below ground surface (bgs). Underlying the younger alluvium is the older alluvial deposits (Victor Formation and the Laguna Formation) that consist of similar interbedded sandy silt, clayey silt, fine to medium-grained sand. Beginning at approximately 100 feet bgs, increasing coarse-grained sands and gravelly lenses have been noted in the boring logs for site monitoring wells. As stream channel deposits, these sedimentary units interfinger and are laterally discontinuous. The Victor Formation is underlain by the Laguna Formation of Plio-Pleistocene age (two million years ago). These older alluvial deposits thicken to about 650 feet in the Stockton area (DWR, 2006).

1.3 SITE HYDROGEOLOGY

The Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins indicates the site is located in the Duck-Littlejohns Hydrologic Area of the San Joaquin River Basin. The San Joaquin Hydrologic Basin is a major regional aquifer system and groundwater in the basin is used for industrial, domestic, and agricultural purposes. The designated beneficial uses of Littlejohns Creek as specified in the Basin Plan, are municipal and domestic supply; agricultural supply; water contact recreation; non-contact water recreation; commercial and sport fishing; warm fresh water habitat; cold freshwater habitat; wildlife habitat; preservation of biological habitats of special significance; migration of aquatic organisms; and spawning, reproduction, and/or early development.

The first encountered groundwater in the site area ranges from about 60 to 80 feet below the ground surface and the depths to water fluctuate by as much as 15 feet between wet and dry seasons. No regionally continuous fine-grained layers have been identified in the Laguna Formation and groundwater is largely unconfined. However, due to the fluvial depositional environment, laterally discontinuous layers of fine-grained soil are present and local areas of groundwater confinement are known to occur

(DWR, 2003). The area surrounding the landfill is primarily agricultural and there are numerous supply wells and irrigation distribution tanks with piping networks to discharge pumped groundwater to the crops in the area. Most of the production wells are constructed to depths on the order of 500 feet or more and produce water from the Laguna Formation.

Groundwater at the Forward Landfill is monitored by 48 groundwater monitoring wells, three domestic wells, and five piezometers (Figure 2). In addition, the Corrective Action Program also includes four active groundwater extraction wells. Data from these wells and piezometers indicate uppermost groundwater beneath the landfill occurs at depths that range from about 50 to 80 feet below ground surface in the younger alluvium and is unconfined. Quarterly groundwater monitoring data for the landfill indicate groundwater in this zone flows to the north-northeast at a hydraulic gradient ranging from about 0.001 to 0.003 feet per foot (ft/ft). Slug tests performed in wells at the Forward Landfill resulted in an estimated hydraulic conductivity of about 0.04 centimeters per second (cm/sec) for the uppermost aquifer beneath the landfill (CH2M Hill, 2000). Assuming an effective porosity of 0.35, the groundwater flow rate is estimated to be about 0.3 to 1 foot per day (ft/day). Depth to water measurements in shallow and deeper well pairs in the EMP wells for the Austin Unit indicate there is no appreciable vertical hydraulic gradient below the Forward Landfill.

In 1989, groundwater downgradient of the Austin Unit was found to be impacted by chlorinated hydrocarbons and in 1991 evaluation monitoring indicated the chlorinated hydrocarbon impacts extended as much as 1,000 feet downgradient of the unit. A Corrective Action Plan (CAP) was approved and implemented in 1991 and included groundwater extraction from 2 wells (EW-1 and EW-2), groundwater treatment through an air stripper, and continued monitoring to assess the effectiveness of corrective action. In 1998, the initial corrective action was judged to be ineffective and a revised Engineering Feasibility Study (EFS) was completed and submitted in 2001. Corrective actions identified in the EFS and implemented at the landfill included:

- Source control through an enhanced landfill gas collection system;
- Installation of two additional groundwater extraction wells (EW-3R and EW-4);
- Construction of a storage basin for treatment system effluent that would subsequently infiltrate and recharge the groundwater;
- Installation of additional groundwater monitoring wells to monitor the effectiveness of the corrective action measures; and
- Installation of a partial final cover on the Austin Unit of the landfill.

Data collected since the enhanced corrective measures were implemented indicate a zone of groundwater affected by VOCs can be mapped approximately as shown in Figure 3 (the principal VOCs of concern include Tetrachloroethene [PCE] and Trichloroethene [TCE]).[1] As shown in this figure, the limits of affected groundwater are well-constrained both laterally and vertically on the west by wells AMW-28, AMW-32S, AMW-32, and AMW-2 and on the east by wells AMW-5R, AMW-30S and AMW-30. The zero line for the vertical and lateral extent of the plume have not been established to the north-northwest, north, and north-northeast.

There have been no exceedances of the total VOC mass threshold limit identified in the *Evaluation Procedures for Proposed Corrective Action at Austin Road Landfill, Addendum to May 2001 Engineering Feasibility Study* (Herst, 2002) and the total VOC mass has been reduced since the since the enhanced corrective actions were implemented (GLA, 2016). The overall shape of the VOC-affected plume with respect to groundwater contours and the distribution of VOCs between the shallow and deep zones indicate the lateral and vertical limits of the VOC-affected groundwater has likely been affected by regional flow conditions (agricultural/industrial pumping, recharge rates, etc.).

2.0 WORKSCOPE

The objective of the scope of work summarized below is to characterize the lateral and vertical extents of VOC-affected groundwater downgradient of the landfill. The following sections describe the proposed work to be completed for the EMP and includes the information required by the Central Valley Regional Water Quality Control Board (CVRWQCB) in its "Requirements for Monitoring Well Installation Workplans and Monitoring Well Installation Reports" (CVRWQCB, 2016).

2.1 INITIAL PROJECT ACTIVITIES

2.1.1 Permitting

Prior to initiating field activities, GLA will obtain well permits from the San Joaquin County Environmental Health Department (SJCEHD). Following permission from the property owner for access and right of way agreement to drill at the proposed well location, GLA will coordinate with Underground Service Alert to identify the locations of known underground utilities in the area of the proposed well locations. In the event significant utilities are identified, and/or if their locations are uncertain, GLA will

[1] Data collected since implementation of the Revised EFS corrective actions shows that some inorganic constituents occasionally exceed their respective concentration limits in downgradient monitoring wells. However, these detections are typically within the range of background for naturally-occurring constituents and provide no direct evidence of an inorganic plume of affected groundwater associated with a release from the facility.

contract with a private utility locator to better characterize their locations.

2.1.2 Health and Safety Plan

GLA will prepare a site-specific Health & Safety Plan (HASP) that will be binding for GLA employees working at the site and that will address the potential hazards associated with conducting the work described below. The HASP will be prepared in accordance with state and federal OSHA regulations and will address potential hazards associated with drilling in a landfill environment such as exposure to landfill gas and landfill-related chemicals, heat and cold-related hazards, engineering controls, air monitoring, and emergency procedures including the route to the nearest hospital.

2.2 WORK SUPERVISION

All work will be observed and monitored by a state-registered professional geologist who will direct and document the drilling and well construction work.

2.3 DRILLING INVESTIGATION

A phased investigation is proposed to further characterize the vertical and lateral limits of VOCs in groundwater downgradient of the ARU. The initial (Phase 1) drilling program will include the drilling and construction of wells AMW-23R, AMW-33, AMW-34, and AMW-35 (Figure 3) and be performed to assess the vertical profile and horizontal limits of VOCs in the deeper groundwater zone. The well locations for the vertical profile/deep zone EMP wells are based on the results presented in the 2016 Annual Corrective Action Evaluation Report (GLA, 2016). If VOCs concentrations greater than the practical quantitation limit (PQL) are detected in the deep wells AMW-33, AMW-34, and AMW-35, additional step out well(s) may be proposed at a later date to characterize the lateral limit in the deep zone. The Phase 2 investigation will be performed to assess the horizontal limits of VOCs in the shallow groundwater zone.

All drilling and well construction will be completed in general accordance with the requirements specified in California Well Standards (Department of Water Resources [DWR] Bulletins 74-81 and 74-90). Proposed deep wells AMW-23R, AMW-33, AMW-34, and AMW-35 will be advanced using air rotary casing hammer (ARCH) and/or mud rotary drilling techniques with a 9-5/8-inch outside diameter (OD) casing. In the event that the ARCH drive casing can no longer be advanced, the borehole will be advanced using mud rotary drilling techniques. These drilling methods were selected because they are able to advance to depths greater and 200 feet, maintain borehole stability, permit identification of stratigraphic units and elevations, allow the identification of the depth to first water, and will facilitate discrete groundwater sampling at depths below first encountered water.

Proposed shallow well pairs AMW-23S, AMW-33S, AMW-34S, and AMW-35S will be drilled using a hollow stem auger drill rig equipped with 8-inch OD auger. This drilling method was selected because it facilitates relatively quick setup, drilling, and well construction. The proposed shallow wells will be drilled and completed after the deeper wells have been completed.

Prior to beginning drilling operations and between well locations, all drill rig equipment will be decontaminated using steam cleaning equipment. Because the drilling operations will not take place near a residential area, noise abatement procedures are not proposed for this project and working hours will be between 6 AM and 6 PM. A temporary borehole protective cover or steel sheeting will be placed on the entry hole during breaks in the drilling process. In the event that a borehole needs to be abandoned during the drilling program, the hole will be sealed with neat cement grout slurry using tremie pipe and positive displacement techniques.

2.3.1 Phase 1 (Vertical Profile) Drilling Investigation

As shown in Figure 3, proposed deeper EMP wells AMW-23R, AMW-33, and AMW-34 are located within the CDCRF property but are outside of the restricted area. Proposed EMP well AMW-23R is located approximately 3600 feet north of the ARU point of compliance and is intended to provide additional information regarding stratigraphy and the vertical extent of VOCs in the center of the plume shown in Figure 3. Proposed well AMW-33 is located approximately 1125 feet south of existing EMP well AMW-26R, and is intended to establish the deep zone northwestern limit of the VOC plume. Proposed well AMW-34 is located approximately 1485 feet south of existing EMP well AMW-25, and is intended to establish the deep zone northern limit of the VOC plume. Proposed well AMW-35 will be located approximately 1575 feet northeast of existing EMP wells AMW-24R/24SR, and is intended to establish the deep zone northeastern limit of the VOC plume. Following a field reconnaissance, the proposed well locations may be modified to facilitate drill rig access, traffic considerations, and/or CDCRF security considerations.

Groundwater Sampling and Analysis – For proposed EMP wells AMW-23R, AMW-33, AMW-34, and AMW-35, groundwater sampling of the first water zone will be performed as a grab sample in the open borehole using a disposable bailer. As summarized above, the first water zone is expected to be encountered about 50-80 feet below the ground surface. Following collection of this sample, the drill string will be advanced to approximately 150 feet bgs and another sample will be collected. Subsequent samples will be collected approximately every 50 feet thereafter to the maximum depth of the boring (500 feet bgs). Beginning at 150 feet, discrete groundwater and soil samples will be collected using a SimulProbe® sampler until VOCs are no longer present.

SimulProbe® samplers are used in exploratory borehole drilling for environmental, water resource, nuclear, and mining industries, to collect discrete soil core and ground water samples. The SimulProbe® is similar to a California Modified Split Spoon sampler and driven into the ground using a 140-pound hammer ahead of the borehole. The core is collected inside the core-barrel chamber within the lower half of the probe. The probe is then lifted 4 inches which opens a compartment that channels the ground water into a water canister within the upper half of the probe through Teflon straws located in the grooved edges running along the length of the core-barrel. The water canister is closed by back-pressure that prevents the escape of VOCs and groundwater while the probe is removed from the borehole.

Immediately following sample retrieval, groundwater from the sampler will be transferred into VOA containers and capped with no airspace to minimize aeration. The sample containers will be placed on ice in an insulated cooler and will be shipped daily to BC Laboratories of Bakersfield California (a state-certified laboratory) with appropriate Chain-of-Custody documentation requesting VOC analysis (USEPA test method 8260B) for the parameters listed in Table VII of Monitoring and Reporting Order No. R5-2014-0006. The Chain-of-Custody documentation will also request a 24-hour turnaround. The borehole will continue to be advanced to the estimated target depth of 500 ft bgs or until VOCs are no longer measured above the PQL. If VOCs are still present at concentrations greater than the PQL at the target depth (500 feet), drilling and discreet sampling will continue at 50 foot intervals until VOCs are less than the PQL. All groundwater samples will be collected in accordance with the Groundwater Sampling and Analysis Plan presented in Appendix A.

2.3.2 Phase 2 Drilling Investigation

Proposed EMP wells AMW-23S, AMW-33S, AMW-34S, and AMW-35S are shallow wells located adjacent to the deeper well, but a minimum of 20 feet away to avoid grout impacts within the well. Each shallow well will be screened within the first water-bearing zone. Proposed EMP well AMW-23S is intended to establish shallow VOC concentrations within the center of the VOC plume; proposed EMP well AMW-33S is intended to establish the shallow zone northwestern limit of the VOC plume; proposed EMP well AMW-34S is intended to establish the shallow zone northern limit of the VOC plume; and proposed EMP well AMW-35S is intended to establish the shallow zone northeastern limit of the VOC plume.

2.4 BOREHOLE LOGGING

A California registered geologist will continuously observe all drilling operations and representative samples of the drill cuttings will be collected and logged at regular intervals during drilling. During ARCH drilling, grab samples will be collected from the

cyclone; for mud rotary drilling, samples will be collected from the drilling mud as it leaves the borehole using a strainer; and for hollow stem auger drilling, grab samples will be collected from the auger flights. Additional drive samples may also be obtained during the drilling program. At a minimum, geologic logging of boreholes will address the following elements:

- Description of soils according to the Unified Soil Classification System and description of bedrock materials according to accepted geologic nomenclature.
- Borehole designation and location.
- Times and dates that drilling/excavation began and ended.
- Type of exploratory equipment being utilized, including manufacturer, make, and model for special modifications.
- Name(s) of geologist(s) responsible for log description.
- Systematic descriptions of lithologic changes in strata or soil horizons including thickness of units, as well as depth and elevation of changes.
- Presence of and depth to groundwater.
- Caving or sloughing conditions in the hole, including depth and elevation.
- Sampling interval(s), including depths and elevations.
- Unusual color, staining, or odors of chemical or waste origin.
- Notes regarding periods of difficult or very easy drilling.
- Any subsurface structures or unusual features encountered.
- An opinion as to the characteristics of water-bearing lithologies.
- Other notes and descriptions as required.

2.5 WELL CONSTRUCTION

For the deep wells, the total depth will be based on the VOC analytical results, with the well screened across the zone with the highest concentration of VOCs. Shallow wells will be screened across the first water bearing zone. The screen sections will also take into account the lithology encountered during drilling and screened across coarser grained section(s) (i.e. sands and gravels) that are capable of mobilizing VOCs downgradient from the landfill.

Permanent well screens and well casing materials will be new, decontaminated and factory sealed materials, and will be covered with plastic or similar protective materials when delivered to the site. All permanent casing will be flush-threaded and a threaded bottom plug will be placed at the base of the well. Centralizers will be placed at the top and bottom of the screen and every 50 feet of blank casing. Sand pack materials will consist of inert washed sands (Monterey or equivalent), and annular seal materials will consist of commercial well sealing bentonite and neat cement grout slurry. Table 1 summarizes the proposed well construction details.

A sand filter pack will extend from the bottom of the boring to three feet above the screened section. The sand filter pack will be placed using positive displacement tremie placement techniques. After tremie placement of the sand filter pack and prior to placement of the five-foot interval of bentonite chip seal, each well will be pre-developed using bailing/surging techniques to settle the sand pack and remove fines. The level of the sand pack within the annulus will be measured both before and after the predevelopment process, and additional sand will be added to the borehole to bring the sand pack to the design elevation.

The bentonite chip seals will be hydrated in one-foot lifts, if necessary, after placement using a minimum of 5 gallons of water. If water must be introduced to hydrate the bentonite chips, the bentonite will then be allowed to stand for a period of not less than 1 hour prior to placement of overlying seal materials. Depth soundings will be utilized to evaluate the thickness and uniformity of the sand pack and bentonite seal, to assure that no bridging occurs.

The annulus above the bentonite chip seal will be filled with neat cement grout slurry with 5% bentonite, pumped into place using positive displacement tremie techniques and will extend from above the bentonite-chip seal to the ground surface. The well will be secured with a locking steel security cover, which will extend approximately three feet above ground level and be grouted into and through a 4-foot by 4-foot, minimum 4-inch thick reinforced concrete pad.

Daily field reports will contain a time log of well construction activities, and an individual well schematic showing well construction details. At a minimum, the well construction log will include the following information:

- Name of geologist and drilling contractor,
- Date and times of drilling and well construction,
- Drilling and well construction methods,
- Drilling fluid composition (if any),
- Type of drill rig,
- Total borehole and well depths,
- Elevation of first groundwater,
- Elevation of groundwater after development of the well,
- Diameter of borehole and casing,
- Length, elevation, and materials used in casing and screen intervals,
- Length, elevation, and materials used for sand filter packs, bentonite chips and grout seals,
- Spacing of casing centralizers,
- Surface completion details, and
- Survey coordinates and elevations of ground surface and top of casing.

2.6 WELL DEVELOPMENT

Following placement of the seal materials, the annular grout will be allowed to cure for a minimum of 48 hours prior to final development. The well will then be developed with a well-development surge block or other methods (e.g. air-lifting), then bailed and/or pumped until visually clear, non-turbid water is discharged from the well, and the temperature, pH, and conductivity of discharge water stabilizes. Well development, groundwater quantities removed, and groundwater sampling data will be recorded on a Water Sample Log Form, and summarized in the well construction log.

2.7 WELL SURVEY

Following the completion of the wells, each well will be surveyed by an experienced land surveyor licensed in the State of California. The survey will include the following.

- The latitude and longitude of the well, in decimal degrees accurate to seven decimal places.
- The elevation of the top of the well monument, accurate to 0.01 foot.
- The elevation of the top of the PVC casing, accurate to 0.01 foot.
- The elevation of the adjacent ground surface, accurate to 0.01 foot.

2.8 CONTAINMENT AND DISPOSAL

Drill cuttings, groundwater, and drilling mud generated during drilling, well construction, and well development will be contained in roll off bins or equivalent secure storage devices and transferred to the Forward Landfill for disposal.

2.9 WELL INSTALLATION REPORT

Approximately three weeks following the well installation and development, a written report will be submitted to the RWQCB that documents the methods and materials that were used to drill and construct EMP wells AMW-23R, AMW-23S, AMW-33, AMW-33S, AMW-34, AMW-34S, AMW-35, and AMW-35S.

3.0 EVALUATION MONITORING PROGRAM STATUS REPORT

Approximately four weeks following completion of field activities and receipt of laboratory analytical results, an EMP Status Report will be prepared and submitted. The report will describe the methods and results of the field investigation described herein, summarize the lateral and vertical extent of the contaminant plume, and will incorporate information derived from previous reports and ongoing environmental and

engineering studies. Any apparent gaps in the database will be identified at this time, and if necessary, work plans will be prepared to supplement the data and resolve any remaining uncertainty for characterization of groundwater impacts at the site.

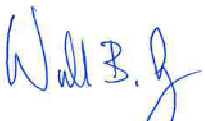
4.0 SCHEDULE

Following RWQCB approval of this workplan and property owner consent. GLA will mobilize within two weeks or the drillers next available date. It is anticipated that drilling and well construction activities may take 6 to 8 weeks to complete; laboratory analytical results will be received within 2 weeks of sampling; the Well Installation Report will take 3 weeks to complete; and the EMP Status Report will take an additional 4 weeks following receipt of the laboratory analytical results.

5.0 CLOSURE

The recommendations presented in this workplan were prepared in accordance with generally accepted professional geotechnical and hydrogeologic principles and practices. This workplan makes no other warranties, either expressed or implied as to the professional advice or data included in it. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, since this may require a reevaluation of the workscope. This workplan has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

Geo-Logic Associates



William B. Lopez, PG, CHG, CEG
Senior Geologist

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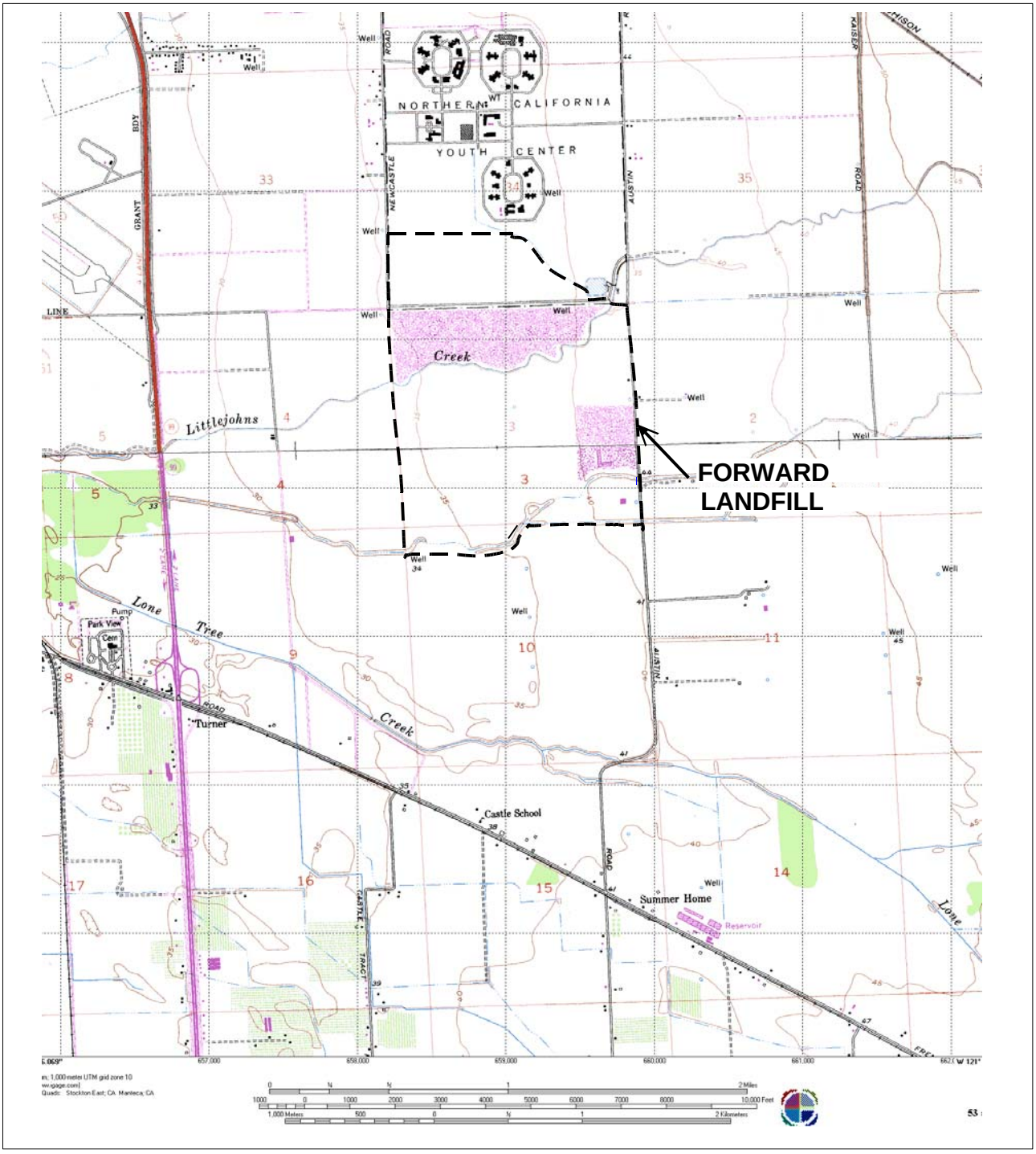
TABLES

TABLE 1
WELL INSTALLATION SUMMARY TABLE
UPDATED EVALUATION MONITORING AND CORRECTIVE ACTION MONITORING WORKPLAN
FORWARD LANDFILL

Well ID	AMW-23R	AMW-23S	AMW-33	AMW-33S	AMW-34	AMW-34S	AMW-35	AMW-35S
Anticipated Depth	To be determined	To be determined	To be determined	To be determined	To be determined	To be determined	To be determined	To be determined
Screened Interval	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)	Bottom 10 to 30 feet (fit accordingly)
Borehole Diameter	9-5/8 inches	8 inches	9-5/8 inches	8 inches	9-5/8 inches	8 inches	9-5/8 inches	8 inches
Well Casing Diameter	4 inches	2 inches	4 inches	2 inches	4 inches	2 inches	4 inches	2 inches
Casing Material	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC	SCH 80 PVC
Screen Material	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots	SCH 80 PVC with 0.020-inch slots
Filter Pack	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent	Monterey Sand #3 or Equivalent
Bentonite Seal	Bentonite Chips	Bentonite Chips	Bentonite Chips	Bentonite Chips	Bentonite Chips	Bentonite Chips	Bentonite Chips	Bentonite Chips
Annular Seal	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite	Neat cement grout with 5% bentonite
Centralizers	Top and bottom of screen; every 50 feet	Top and bottom of screen	Top and bottom of screen; every 50 feet	Top and bottom of screen	Top and bottom of screen; every 50 feet	Top and bottom of screen	Top and bottom of screen; every 50 feet	Top and bottom of screen

FIGURES



REFERENCE: U.S.G.S. 7.5 Minute Topographic Series, Manteca, 1994, and Stockton East, 1987, CA.

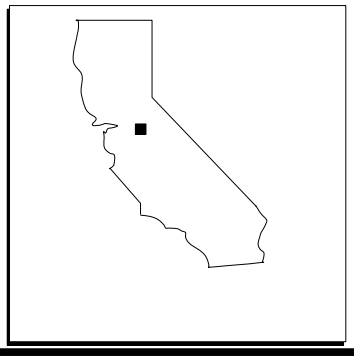


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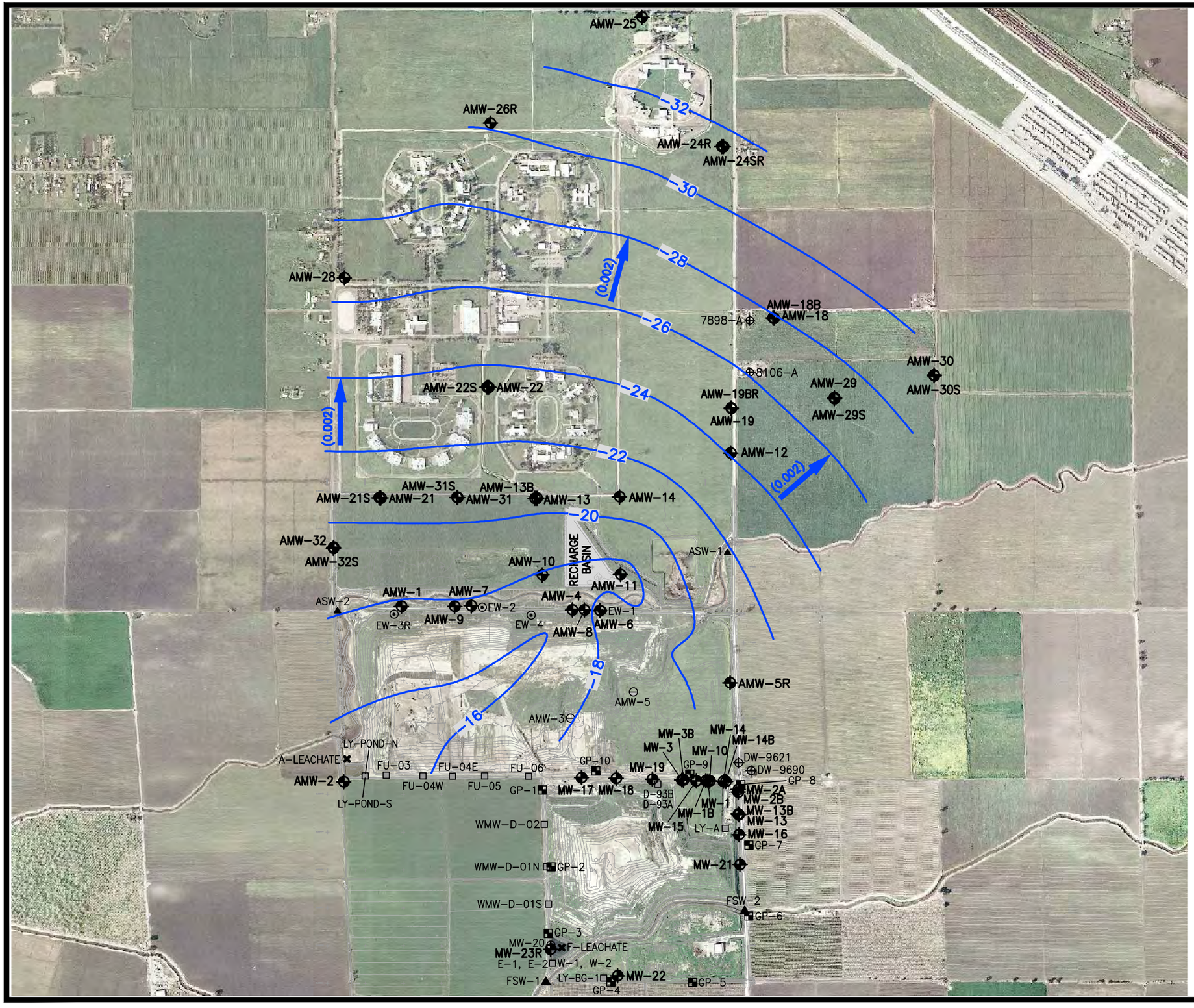
FIGURE 1

VICINITY MAP

UPDATED EVALUATION MONITORING AND CORRECTIVE ACTION MONITORING WORKPLAN
FORWARD LANDFILL, STOCKTON, CA

Geo-Logic ASSOCIATES

Draft: JGF	Date: 9/2016	Project No. 2016.0007



EXPLANATION:

- MONITORING WELL LOCATION
- SURFACE WATER SAMPLING LOCATION
- ABANDONED MONITORING WELL LOCATION
- OFF-SITE DOMESTIC WELL LOCATION
- EXTRACTION WELL LOCATION
- SOIL-PORE GAS PROBE LOCATION
- LYSIMETER LOCATION
- LEACHATE SAMPLING POINT
- MAY 2016 GROUNDWATER POTENTIOMETRIC SURFACE ELEVATION CONTOUR (CONTOUR INTERVAL = 2 FEET)
- (0.002) GROUNDWATER FLOW DIRECTION AND RATE (ft./ft.)

REFERENCES:

1. AERIAL IMAGE FROM AE, LLC, 2005
2. TOPOGRAPHIC BASE MAP DATED 3/02/2012

N

GRAPHIC SCALE

650 0 325 650 1300

(in feet)

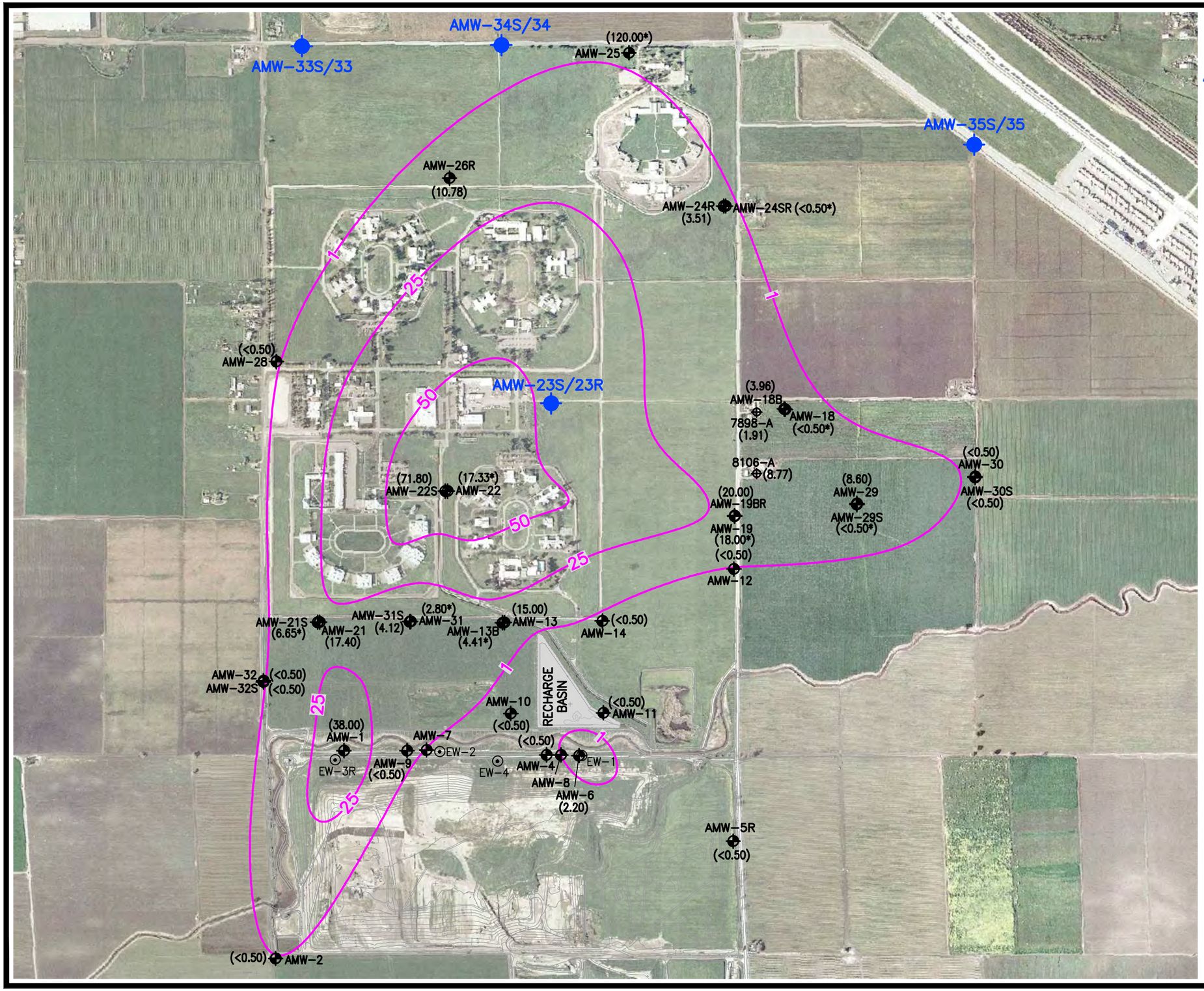
FIGURE 2

MONITORING POINTS LOCATION MAP

UPDATED EVALUATION MONITORING AND CORRECTIVE ACTION MONITORING WORKPLAN
FORWARD LANDFILL
STOCKTON, CALIFORNIA

Geo-Logic ASSOCIATES

DRAWN BY: VL	DATE: SEPTEMBER 2016	JOB NO. 2016.0007



EXPLANATION:

AMW-35S/35	PROPOSED EMP WELL LOCATION
AMW-1	MONITORING WELL LOCATION
EW-1	EXTRACTION WELL LOCATION
8106-A	OFF-SITE DOMESTIC WELL LOCATION
(71.80)	MAY 2016 TOTAL VOC CONCENTRATION (μg/L)
*	DATA NOT USED TO CONSTRUCT CONTOURS (SUSPECTED LAB CONTAMINANT)
25	MAY 2016 TOTAL VOC CONCENTRATIONS CONTOUR (μg/L)

REFERENCES:

1. AERIAL IMAGE FROM AE, LLC, 2005
2. TOPOGRAPHIC BASE MAP DATED 3/02/2012

N

GRAPHIC SCALE

550 0 275 550 1100

(in feet)

FIGURE 3

PROPOSED EMP WELL LOCATIONS

UPDATED EVALUATION MONITORING AND CORRECTIVE ACTION MONITORING WORKPLAN
FORWARD LANDFILL
STOCKTON, CALIFORNIA

Geo-Logic ASSOCIATES

DRAWN BY:	DATE:	JOB NO.
VL	SEPTEMBER 2016	2016.0007

APPENDIX A

SAMPLING AND ANALYSIS PLAN

SAMPLING AND ANALYSIS PLAN

This sampling and analysis plan describes the methods and procedures that will be used to collect water quality samples during the Evaluation Monitoring and Corrective Action Monitoring program investigation at the Forward Landfill.

Laboratory Analytical Methods

Chemical analyses will be performed by BC Laboratories, a state-certified laboratory. For the vertical profile, discreet groundwater samples will be analyzed for volatile organic compounds (VOCs) parameters listed in Table VII of Monitoring and Reporting (M&RP) Order No. R5-2014-0006. After well construction and development, groundwater samples will be analyzed for all of the routine quarterly parameters listed in Table I of (M&RP) Order No. R5-2014-0006.

Well Purging and Sampling

The following sampling protocols listed below will be followed during groundwater sampling operations:

- Upon arrival at the wellhead, each monitoring point was inspected for evidence of tampering and/or vandalism, and the well identification (I.D.) was recorded.
- Prior to placing any non-dedicated sampling equipment (water-level indicator, pumps, bailers) into a well, the sampling equipment will be decontaminated using a steam cleaner and rinsed with deionized water or decontaminated using an Alconox® soap solution, followed by two rinses with deionized water.
- The water level was measured directly using a weighted water-level indicator (sounder) to an accuracy of 0.01 foot and the total depth of the well (if obtainable) were recorded on a Well Data Sheet.

<u>Groundwater Sampling Using Traditional Well Sampling Methods</u>

Following construction and development of the proposed Evaluation Monitoring Program (EMP) wells, groundwater sampling will be performed using traditional well sampling methods described below.

- Each well with sufficient recharge was purged of a minimum of three casing volumes and allowed to recover to 80 percent of the original well volume prior to sampling. Each well will be purged using a non-dedicated bailer and/or electric submersible pump, and sampled using a disposable bailer. Each Based on the measured depth to water, the total depth of the well, and the known casing diameter, a well casing volume was calculated using the following equation:

$CV = (\pi)(CD/2)^2 (HW)(7.48)$

where:

CV	=	casing volume (gallons)
CD	=	casing diameter (feet)
HW	=	height of water column within well (feet)
7.48	=	conversion from cubic feet to gallons.

- A U-50 Water Quality Meter® (or equivalent) will be used to measure oxygen reduction potential (ORP), pH, specific conductance (EC), temperature, and turbidity. After approximately every casing volume of purging, field parameters will be recorded on a Well Data Sheet, and groundwater samples will be collected after the total estimated purge volume was reached and the monitoring parameters have stabilized.
- The pumping rate is reduced during evacuation of the last casing volume so that sampled water is not subject to unnecessary agitation. If a bailer is used, the bailer is slowly lowered to minimize agitation of the water column.

Vertical Profile Groundwater Sampling Methods

After identification of the first groundwater zone,, a discreet grab sample will be initially collected using a disposable bailer. Subsequent grab samples will be collected using a SimulProbe® sampler for discreet sampling below first water (beginning at approximately 150 feet below ground surface).

- For samples collected using a disposable bailer, a bottom-emptying device will be inserted into the bailer, and the sample transferred directly from the bailer to the sample containers.
- The SimulProbe® sampler is similar to a California Modified Split Spoon sampler and driven into the ground using a 140-pound hammer ahead of the borehole. The sampler is then lifted 4 inches which opens a compartment that channels the ground water into a water canister within the upper half of the probe through Teflon straws located in the grooved edges running along the length of the core-barrel. The water canister is closed by back-pressure that prevents the escape of VOCs and groundwater while the probe is removed from the borehole. Immediately following sample retrieval, groundwater from the SimulProbe® sampler will be transferred directly into the sample containers.

Sample Collection and Handling

- Each sample will be collected in approved laboratory supplied sample containers filled completely and immediately capped, labeled, and placed in a cooler with ice.
- Samples will be collected in order of volatility. VOCs first, followed by general chemistry, and metals.
- Samples for VOC analysis will be filled by pouring the sample down the sides of the container to minimize aeration and capped with no airspace.
- Dissolved metals samples will be collected in unpreserved bottles and filtered/preserved at the laboratory.

- Collected samples, accompanied by a trip blank, will be placed immediately in an ice-filled cooler for transport to the state-certified testing laboratory. Samples will be kept chilled (at about 4°C) until delivery.
- A completed Chain-of-Custody form, detailing the sample I.D., date and time collected, analyses requested, and other project information, will accompany each sample to the laboratory. The Chain-of-Custody forms will be signed and dated by all personnel retaining custody of the samples.

Field Equipment and Calibration

Proper maintenance, calibration, and operation of each field instrument are the responsibility of the field personnel and the instrument technicians assigned to the project. All instruments and equipment used during the program will be maintained, calibrated, and operated according to the manufacturers' guidelines and recommendations.

Field equipment will be calibrated prior to use in the field as appropriate. The calibration procedures follow standard manufacturers' instructions to ensure that the equipment is functioning within established tolerances and as required by the project. All instruments will be stored, transported, and handled with care to preserve equipment accuracy. Damaged instruments will be taken out of service immediately and not used again until a qualified technician repairs and recalibrates the instruments.

Calibration Procedures

Equipment calibration will be performed in accordance with the manufacturer's instructions, and calibration checks are performed each day prior to the start of work. Calibration of rental equipment will be performed by a qualified technician prior to shipment of the equipment.

Calibration standards will be used once. Spent calibration liquids will be placed in plastic bottles and transported off-site for disposal. A brief summary of the calibration procedures for field measurement equipment is provided below:

- pH: Calibration for pH will be performed prior to commencement of sampling activities, using standard buffer solutions having pH values of 4, 7, and 10. Calibration checks for pH values using buffer solutions of 4, 7, and 10 will be performed daily. If the reading varies more than 0.10 of a unit between calibration checks, the meter will be recalibrated.
- Conductivity: Calibration for conductivity will be performed prior to commencement of sampling activities, using potassium chloride (KCl) standard solutions with conductivity values of 1,000 and 10,000 microsiemens/cm. The meter must read within one percent of full-scale to be considered calibrated. A calibration check for conductivity will be performed daily.
- Turbidity Meter: Turbidity range calibration will be performed prior to initiation of sampling activities, using turbidity gel standards of 0, 4.4, 45, and 483 NTUs. The meter will also checked daily during the sampling period with the standard most representative of the

anticipated turbidity of the purged groundwater (typically 0 NTUs to 10 NTUs). If the reading varies by more than one unit between calibration checks, the meter will be recalibrated.

- Multiple Sensor Meter (pH, Dissolved Oxygen, Conductivity, Temperature, Turbidity): A multiple sensor meter may be used for multiple parameter measurements during sampling. Calibration will be performed prior to initiation of sampling activities, using manufacturer auto-calibration solution. If any of the readings are outside of the manufacturers specifications, the meter will be recalibrated for the parameter outside of the calibration range. Calibration checks are performed daily.

Equipment not listed herein will be calibrated according to manufacturers' recommendations and/or generally accepted practice. Calibration procedures will be documented for the project file. Instruments for which calibration cannot be easily checked will be either tested against another instrument of a similar type, or will be returned to the manufacturer for appropriate calibration. If tested against another instrument capable of making the same measurements, variation between instruments must not exceed five percent. If readings vary more than five percent, the instrument will be returned to the manufacturer for calibration.

ATTACHMENT F

REQUIREMENTS FOR MONITORING WELL INSTALLATION WORKPLANS AND MONITORING WELL INSTALLATION REPORTS

Prior to installation of groundwater monitoring wells, the Discharger shall submit a workplan containing, at a minimum, the information listed in Section 1 below. Wells may be installed after staff approves the workplan. Upon installation of the monitoring wells, the Discharger shall submit a well installation report that includes the information contained in Section 2 below. All workplans and reports must be prepared under the direction of, and signed by, a registered geologist or civil engineer licensed by the State of California.

SECTION 1 - Monitoring Well Installation Workplan and Groundwater Sampling and Analysis Plan

The monitoring well installation workplan shall contain the following minimum information:

A. General Information:
   Purpose of the well installation project
   Brief description of local geologic and hydrogeologic conditions
   Proposed monitoring well locations and rationale for well locations
   Topographic map showing facility location, roads, and surface water bodies
   Large scaled site map showing all existing on-site wells, proposed wells, surface drainage courses, surface water bodies, buildings, waste handling facilities, utilities, and major physical and man-made features

B. Drilling Details:
   On-site supervision of drilling and well installation activities
   Description of drilling equipment and techniques
   Equipment decontamination procedures
   Soil sampling intervals (if appropriate) and logging methods

C. Monitoring Well Design (in narrative and/or graphic form):
   Diagram of proposed well construction details:
   - Borehole diameter
   - Casing and screen material, diameter, and centralizer spacing (if needed)
   - Type of well caps (bottom cap either screw on or secured with stainless steel screws)
   - Anticipated depth of well, length of well casing, and length and position of perforated interval
   - Thickness, position and composition of surface seal, sanitary seal, and sand pack
   - Anticipated screen slot size and filter pack

D. Well Development (not to be performed until at least 48 hours after sanitary seal placement):
   Method of development to be used (i.e., surge, bail, pump, etc.)
   Parameters to be monitored during development and record keeping technique
   Method of determining when development is complete

Disposal of development water

E. Well Survey (precision of vertical survey data shall be at least 0.01 foot):
Identify the Licensed Land Surveyor or Civil Engineer that will perform the survey
Datum for survey measurements
List well features to be surveyed (i.e. top of casing, horizontal and vertical coordinates, etc.)

F. Schedule for Completion of Work

G. Appendix: Groundwater Sampling and Analysis Plan (SAP)
The Groundwater SAP shall be included as an appendix to the workplan, and shall be utilized as a guidance document that is referred to by individuals responsible for conducting groundwater monitoring and sampling activities.

Provide a detailed written description of standard operating procedures for the following:

- Equipment to be used during sampling
- Equipment decontamination procedures
- Water level measurement procedures
- Well purging (include a discussion of procedures to follow if three casing volumes cannot be purged)
- Monitoring and record keeping during water level measurement and well purging (include copies of record keeping logs to be used)
- Purge water disposal
- Analytical methods and required reporting limits
- Sample containers and preservatives
- Sampling
  - General sampling techniques
  - Record keeping during sampling (include copies of record keeping logs to be used)
  - QA/QC samples
- Chain of Custody
- Sample handling and transport

SECTION 2 - Monitoring Well Installation Report

The monitoring well installation report must provide the information listed below. In addition, the report must also clearly identify, describe, and justify any deviations from the approved workplan.

A. General Information:
Purpose of the well installation project
Brief description of local geologic and hydrogeologic conditions encountered during installation of the wells
Number of monitoring wells installed and copies of County Well Construction Permits

Topographic map showing facility location, roads, surface water bodies
Scaled site map showing all previously existing wells, newly installed wells, surface water bodies, buildings, waste handling facilities, utilities, and other major physical and man-made features.

B. Drilling Details (in narrative and/or graphic form):
On-site supervision of drilling and well installation activities
Drilling contractor and driller's name
Description of drilling equipment and techniques
Equipment decontamination procedures
Soil sampling intervals and logging methods
Well boring log:
- Well boring number and date drilled
- Borehole diameter and total depth
- Total depth of open hole (same as total depth drilled if no caving or back-grouting occurs)
- Depth to first encountered groundwater and stabilized groundwater depth
- Detailed description of soils encountered, using the Unified Soil Classification System

C. Well Construction Details (in narrative and/or graphic form):
Well construction diagram, including:
- Monitoring well number and date constructed
- Casing and screen material, diameter, and centralizer spacing (if needed)
- Length of well casing, and length and position of perforated interval
- Thickness, position and composition of surface seal, sanitary seal, and sand pack
- Type of well caps (bottom cap either screw on or secured with stainless steel screws)

E. Well Development:
Date(s) and method of development
How well development completion was determined
Volume of water purged from well and method of development water disposal
Field notes from well development should be included in report

F. Well Survey (survey the top rim of the well casing with the cap removed):
Identify the coordinate system and datum for survey measurements
Describe the measuring points (i.e. ground surface, top of casing, etc.)
Present the well survey report data in a table
Include the Registered Engineer or Licensed Surveyor's report and field notes in appendix