RESULTS REPORT
FOR PRE-DESIGN DATA COLLECTION ACTIVITIES

Corporation Yard Landfill Clean Closure

Folsom, California

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Prepared for:

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1.0 INTRODUCTION

Field activities were conducted from February 6 to 11, 2008 to support the design of the clean closure project at the City of Folsom Corporation Yard Landfill located at 1300 Leidesdorff Street in Folsom, California (Site). The City of Folsom is planning to clean close the landfill by removing the waste to prepare the Site for redevelopment. Test pits were excavated to complete the investigation of the nature and extent of landfill waste and to estimate waste volumes for removal. Soil samples were collected from dredge tailings beneath and surrounding the landfill to assess levels of naturally occurring metals and soluble parameters. The field activities were conducted according to the *Work Plan for Pre-Design Data Collection Activities* and amendment (Brown and Caldwell; 2008a, 2008b) which were approved by the Regional Water Quality Control Board, Central Valley Region (RWQCB) on January 29, 2008. The results presented in this report will be incorporated into the final version of the *Draft Final Amended Report of Waste Discharge (AROWD) / Clean Closure Work Plan* (Brown and Caldwell, 2008c).

1.1 Objectives

The objectives of this results report are listed below.

- Provide additional soil and solid waste data that will assist in estimating volumes of material that will require removal during clean closure. This activity was not intended to produce data to characterize waste for future acceptance at off-site disposal facilities.

- Assess levels of naturally occurring metals within soils outside areas affected by the landfill operations for use in developing cleanup goals for clean closure.

1.2 Overview

The landfill occupies approximately 4 acres of the 18-acre Folsom Corporation Yard situated along the southern bank of Lake Natomas. Elevations across the Site range between 145 and 160 feet above mean sea level (MSL). A municipal wastewater treatment plant was constructed on the Corporation Yard property in the 1950s and operated through the early 1970s. In 1974, the City of Folsom began using the former settling lagoons associated with the former wastewater treatment plant as a landfill. The landfill operated between 1974 and 1986 and was permitted as a Class III sanitary landfill in 1978. The fill consists mostly of construction and demolition debris, green waste, and street litter. In July 1996, the existing landfill cap was constructed as part of the formal closure of the landfill. The cap consists of three layers totaling approximately 4 feet:

- 12-inch vegetative soil layer;
- 12-inch clay layer; and
- 24-inch foundation layer.

The northern portion of the landfill cap features a 180-foot by 240-foot parking lot for City employee parking. The landfill cap in this area consists of four layers totaling approximately 4 feet:

- 2.5-inch asphalt concrete Type B;
- 10-inch aggregate base rock Class 2;
- 12-inch clay layer; and
- 24-inch foundation layer.

The unpaved southwestern half has been graded for drainage (i.e., no ponding) and is vegetated with annual grasses.

1.3 Previous Investigations

In October 2000, a geotechnical and environmental evaluation of the landfill was conducted as part of a study to evaluate remedial alternatives for the Site. The results of this investigation were presented in the document *Landfill Remediation, Corporation Yard Conversion* (Kleinfelder, 2000). Under this investigation, four large-diameter (3-foot) borings (BA-1 through BA-4) were drilled and 24 test pits (TP-1 through TP-24) were excavated to assess the nature and extent of the fill, determine geotechnical parameters, and provide engineering cost estimates. The location of these borings and test pits are shown on Figure 1. In the main landfill area, the debris consisted mostly of soil with some concrete, asphalt, green waste, metal, and trash. The investigation also indicated that debris fill extended south of the landfill cap and the former settling lagoons. This area is referred to as the "uncontrolled fill area" and the debris included mostly soil with some household waste such as newspaper, carpet, and tires. The outline of the main landfill area and the uncontrolled fill area are shown on Figure 1. The maximum depth of fill was determined to be 12 feet below ground surface (bgs).

During the 2000 geotechnical investigation, the equipment used for excavation of test pits could only obtain a maximum depth of approximately 10 feet, and the majority of test pits did not fully penetrate the waste material and underlying clay material of the former wastewater treatment lagoons. In addition, although debris was described within the trench logs and soil borings, estimates of the volume of different material types (e.g., concrete and green waste) were not recorded. Therefore, an objective of the February 2008 pre-design investigation was to fully penetrate the waste material and provide additional data for estimating waste volume types.

In April 2006, eight additional test pits (TPA-1 through TPA-8) were excavated to further define the extent of the uncontrolled fill area. The location of these test pits are shown on Figure 1. The results of this investigation were presented in the document *Results of Limited Investigation to Further Define Lateral Extent* (Brown and Caldwell, 2006). The test pits confirmed that the uncontrolled fill area contains inert household type waste to a depth of 8 feet bgs. Items

observed in the test pits included tires, asphalt, concrete, metal, plastic, glass, rubber, and some burn ash. No odors or staining were noted during the field activities.

1.4 Target Parameters

The *Draft Final AROWD / Clean Closure Work Plan* (Brown and Caldwell, 2008c) identified parameters in soil/solid media that would be targeted during confirmation sampling at the end of the clean closure project. The target parameters for soil/solid media consist of CAM 17 metals and soluble nitrate and sulfate. Since these parameters may occur naturally within Site soils, data was collected to assess background levels (i.e., concentrations of metals, nitrate, and sulfate that would exist without the influence of the landfill) within the material that is expected to underlie the waste. The landfill and former wastewater treatment plant lagoon sediments are underlain by historical gold dredge tailings over most of the Site and possibly silts and clays of the Mehrten Formation along the eastern edge of the landfill.

1.5 Report Organization

The remainder of this report summarizes the methods and procedures used to conduct the field activities. Results from the field activities are presented and interpreted. Statistical methods were applied to the analytical data to determine background levels of target parameters.

2.0 METHODS AND PROCEDURES

This section presents the methods and procedures that were used during the pre-design data collection activities. Field activities consisted of backhoe excavations and soil sampling. All field activities were conducted under the supervision of a California Professional Geologist. Prior to excavation, all locations were cleared of buried utilities by notifying Underground Service Alert.

Field work was conducted under the *Health and Safety Plan, Corporation Yard Landfill Clean Closure Activities* (Brown and Caldwell, 2008d) that was prepared prior to commencement of field activities. A Site safety briefing was held prior to the beginning of each work day. The Site safety briefings included: a discussion of the daily tasks; personal protective equipment required for the tasks; chemical and physical hazards present; and a reminder of the location of the hospital route. Topics covered in the Site safety briefings were recorded on the Site Safety Briefing Form and signed by all individuals present at the meetings.

During invasive activities (i.e., backhoe excavations), air monitoring for the presence of volatile organic compounds (VOCs) and combustible gases was conducted. VOCs were monitored using a Thermo 588 organic vapor monitor equipped with a photoionization detector (PID). Combustible gases were

monitored using a Gas Tech Combustible Gas Indicator (CGI). All gas measurements were below action levels specified in the Health and Safety Plan.

2.1 Test Pit Excavation and Soil Sampling

A total of eleven test pits (TPB-1 through TPB-11) were excavated at the locations shown on Figure 1. Nine test pits (TPB-1 through TPB-9) were originally proposed in the work plan; two additional test pits (TPB-10 and TPB-11) were added during the investigation to assist in further characterization of the uncontrolled fill area. A larger backhoe was used than in the 2000 investigation so that greater depths could be reached. Each test pit was excavated until either dredge tailing material or native soil was encountered to provide information on the full thickness of the waste material and underlying wastewater lagoon material. Information from test pits TPB-5 through TPB-11 was also used to further delineate the lateral extent of the uncontrolled fill area.

For test pits excavated within the capped landfill area (TPB-1 through TPB-4), the vegetative soil and clay layers were removed separately and placed on plastic. This procedure allowed the clay cap material to be replaced and compacted on top of the waste after backfilling of the test pit, minimizing the chance of water infiltration during rain events that might occur prior to clean closure activities. After sampling and logging of the excavation, material was backfilled using a combination of the backhoe bucket and a sheepsfoot compaction tool. The clay and soil layers were then replaced and compacted by tracking the backhoe over the test pit. To avoid surface water ponding, the surface elevation of the backfilled test pits was compacted to match the surrounding grade. For test pits TPB-1 and TPB-2 located within the parking lot, the above procedure was followed and the asphalt pavement was restored. Photos of these field activities are located in Appendix A.

Observations and sample collection were conducted outside the excavations, and no personnel were allowed to enter the excavations. Once the excavation was completed, the exposed excavation walls were then photographed and logged by the field geologist using a standard excavation logging form. Soils/wastes were described using the Unified Soil Classification System. Information such as depth to contacts between fill layers and waste types such as green waste and concrete were listed on the logging form. Logs of the test pits are provided in Appendix B.

A total of 13 primary soil samples and one duplicate soil sample were collected from the test pits as shown in the table below. Soil samples were collected using a backhoe bucket. Care was taken to select material that had not been in contact with the sides of the bucket of slough material from other areas of the excavation. In test pit TPB-4, water was found in the excavation at approximately 11 feet bgs. A water sample was collected from this location in addition to the soil sample.

Test Pit Soil Samples			
Test Pit	**Sample ID**	**Depth (ft bgs)**	**Type**
TPB-1	TPB-1A	16	Primary
	TPB-1B	19	Primary
TPB-2	TPB-2A	17	Primary
TPB-3	TPB-3A	13	Primary
TPB-4	TPB-4	11	Primary
TPB-5	TPB-5	4	Primary
TPB-6	TPB-6	3	Primary
TPB-7	TPB-7	7	Primary
TPB-8	TPB-8	4	Primary
	TPB-8D	4	Duplicate
	TPB-8A	8	Primary
TPB-9	TPB-9	3	Primary
TPB-10	TPB-10	5	Primary
TPB-11	TPB-11	8	Primary

Samples were immediately placed into a clean glass jar. All samples were properly labeled and placed into a cooler with ice for transportation to the laboratory. Test pit soil samples were analyzed for CAM17 total metals and soluble nitrate and sulfate, pH, and EC. Analysis of the soluble parameters were added upon request by the RWQCB in the work plan amendment (Brown and Caldwell, 2008b). To determine soluble nitrate and sulfate, the laboratory prepared the soil samples by the Waste Extraction Test (WET) method using de-ionized (DI) water as the extractant (i.e., DI-WET). The results for soluble nitrate and sulfate are presented in this report as milligrams per kilogram (mg/kg); the laboratory can report the soluble parameters in milligrams per liter (mg/L) by dividing the results by ten. To determine pH and EC of the soil, equal parts soil and DI water were mixed to form a paste. The water sample from test pit TPB-4 was filtered at the laboratory and analyzed for dissolved CAM17 metals.

2.2 Background Soil Sampling

To provide information on the background levels of target parameters, 20 soil samples were collected at 1 foot bgs at locations SS01 through SS20 shown in Figure 2. These locations are along the perimeter of the Site outside the boundaries of the main landfill and uncontrolled fill areas. No evidence of landfill operations was observed within any of the background locations. A duplicate soil sample was collected at locations SS02 and SS03. The background soil samples were collected and handled in the same manner as the soil samples from the test pits. To minimize the potential for cross-contamination during sample collection, the backhoe bucket was decontaminated using a power washer prior to and after trenching at each location. Background soil samples were analyzed for CAM17 total metals and soluble nitrate and sulfate, pH, and EC.

3.0 RESULTS AND INTERPRETATION

The laboratory reports for analysis of test pit and background samples are provided in Appendix C. A review of the data quality was conducted and summarized in Appendix C. The review included the items listed below.

- Sample Documentation
- Sample Holding Times
- Laboratory and Field Blank Review
- Matrix Spike/Matrix Spike Duplicate Recovery and Precision
- Field/Laboratory Duplicate Review
- Laboratory Control Sample Review
- Sample Quantitation

Overall, the data are acceptable for the intended purposes. No results were rejected. Some results were qualified as estimated (i.e., flagged with a "J") due to matrix spike recoveries outside of control limits and duplicate precision over 50 percent.

3.1 Test Pit Excavation and Soil Analytical Results

The nature of the waste material in the main landfill area is primarily soil (approximately 85% of total fill) with decreasing amounts of the following materials: concrete, asphalt, scrap lumber/green waste, metal items, and trash. The nature of the waste material in the uncontrolled fill area is also primarily soil (approximately 75% of total fill) with the remainder composed of household trash such as potting soil bags, silverware, plastic sheeting, metal/plastic pipe, glass bottles, garden hose, and clothing. These findings agree with the results of previous investigations.

Test pits TPB-1 through TPB-4 refined the delineation of the vertical extent of waste as shown on the longitudinal cross section A-A' provided in Figure 3. The backhoe used was adequate for penetrating to the dredge tailings beneath the landfill and a maximum excavation depth of 19 feet bgs was achieved. At TPB-1, the clay and plastic liner encountered at 16 feet bgs were interpreted to be the liner of the former wastewater treatment plant aeration lagoon. The 16-foot depth corresponds well with the understanding of the subsurface which indicates a 4-foot engineered landfill cap overlying a 12-foot deep aeration lagoon filled with fill soil and debris. The former wastewater treatment plant lagoon liner was not evident in test pits TPB-2 through TPB-4, and there have been historical reports that the liner was disturbed during landfill operations. Dredge tailings were encountered at shallower depths moving south along the longitudinal axis of the landfill: 17 feet bgs at TPB-2, and 13 feet bgs at TPB-3. This corresponds well with the understanding of the former wastewater treatment plant settling lagoon which was a maximum of 8 feet deep near TPB-2 and became shallower near TPB-4. The waste in the uncontrolled fill area is between 3 and 8 feet deep.

Test pits TPB-5 through TPB-11 refined the delineation of the lateral extent of waste in the uncontrolled fill area as shown on lateral cross section B-B' provided in Figure 4. Waste is bounded to the southeast and east by test pits TPB-8 and TPB-9, respectively, which were free of debris. Waste was encountered near the fence line at test pits TPB-5 and TPB-7. Note that the Corporation Yard property boundary is beyond the fence line and that the construction contractor will be required to remove the fence as necessary to remove waste.

Analytical results for the 13 test pit soil samples are summarized in Table 1. All CAM 17 metals were detected above method detection limits in at least one sample with the exception of antimony. Arsenic was detected in all samples at a range of 2.2 to 9.4 mg/kg. Soluble nitrate and sulfate, pH, and EC results are summarized in Table 1 and posted by the sampling location on Figure 5. Soluble nitrate was detected in all samples at a range of 3.9 to 84 mg/kg. The maximum soluble nitrate result of 84 mg/kg was detected at TPB-3 at a depth of 13 feet bgs. Soluble sulfate was detected in all samples at a range of 5.9 to 91 mg/kg. The maximum soluble sulfate result of 91 mg/kg was detected at TPB-11 at a depth of 8 feet bgs. Results for pH ranged from 5.9 to 7.9 standard units. The minimum pH result of 5.9 standard units was detected at TPB-5 at a depth of 4 feet bgs. Results for EC ranged from 6.0 to 74 micromhos per centimeter (µmhos/cm). The maximum EC result of 74 µmhos/cm was detected at TPB-3 at a depth of 13 feet bgs.

3.2 Test Pit TPB-4 Water Results

Perched water was encountered in test pit TPB-4 at a depth of 11 feet bgs. Groundwater elevations were immediately measured in all monitoring wells. Groundwater elevations (excluding FCY-3 and FCY-7 completed in the Mehrten Formation) ranged from 128.19 to 129.75 ft MSL which is similar to 4Q 2007 measurements of 128.00 to 129.34 ft MSL. The landfill cap elevations range from 156 ft MSL at the north end to 145 ft MSL at the south end as shown on Figure 3. TPB-4 was dug at an elevation of approximately 148 ft MSL and water was encountered at 11 feet or approximately 137 ft MSL. Thus, water encountered in test pit TPB-4 was approximately 7 feet above groundwater at the Site. Analytical results of the water in test pit TPB-4 are provided in Table 2. Only two of the CAM 17 dissolved metals were detected: barium at 350 mg/L and zinc at 100 mg/L. Soluble nitrate was reported at 4.2 mg/kg and sulfate at 27 mg/kg. pH was reported at 7.04 standard units and EC was reported at 41 µmhos/cm.

3.3 Background Soil Analytical Results

Analytical results for the background soil samples are summarized in Table 3. All CAM 17 metals were detected above method detection limits in at least one sample with the exception of antimony. Arsenic was detected in all samples at a range of 2.0 to 6.9 mg/kg. Note that the test pit soil sample results for CAM 17 metals are similar to the background soil sample results in that the same 12

metals are detected frequently and have similar calculated means. Soluble nitrate and sulfate, pH, and EC results are summarized in Table 3 and posted by the sampling location on Figure 5. Soluble nitrate was detected in all samples at a range of 3.3 to 25 mg/kg. Soluble sulfate was detected in all samples at a range of 3.2 to 42 mg/kg. Results for pH ranged from 6.0 to 7.4 standard units. Results for EC ranged from 2.0 to 23 µmhos/cm. Note that the calculated means for test pit soil sample results for soluble nitrate, sulfate, and EC are three to four times the calculated means for the background soil sample results. Soluble pH results were nearly the same for both soil sample groups.

Soil background concentration limits (BCL) were developed for CAM 17 metals, and soluble nitrate and sulfate. A summary of those BCLs are provided in the table below. Details of the statistical methodology are presented in Appendix D, and are briefly described here.

Background Concentration Limits	
Analyte	**Value (mg/kg)**
Antimony	2.0
Arsenic	10
Barium	234
Beryllium	0.80
Cadmium	0.97
Chromium	143
Cobalt	24
Copper	87
Lead	105
Mercury	0.28
Molybdenum	1.8
Nickel	78
Selenium	0.52
Silver	0.43
Thallium	0.66
Vanadium	103
Zinc	92
Nitrate as NO3	28
Sulfate as SO4	48

The BCL was set equal to the 95% Chebyshev upper prediction limit (UPL) for all constituents with a sufficient number of detected values. The mean and standard deviation, which are required for calculation of the Chebyshev UPLs, were determined using the Kaplan-Meier method for censored data if nondetects were present in the data. Otherwise, arithmetic values for the mean and standard deviation were calculated in Microsoft Excel.

4.0 CONCLUSIONS

Excavation of test pits TPB-1 through TPB-11 provided data sufficient to refine volume estimates of material that will require removal during clean closure. The water encountered in test pit TPB-4 indicates that there may be some perched water in the waste that will need to be addressed during excavation of waste for clean closure. Background values (i.e., BCLs) were calculated for CAM 17 and soluble nitrate/sulfate for soil at the Site. These values will assist in developing clean up goals for the Site which will be presented to regulatory agencies in a separate document.

5.0 REFERENCES

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APPENDIX A. PHOTOGRAPHY

APPENDIX B. TEST PILOT LOGS