TECHNICAL MEMORANDUM

Date:	5/27/16	**Project No.:**	1655230
To:	Sam Barket	**Company:**	Lehigh Hanson
From:	George Wegmann, PG Bill Fowler, PG, CEG		
cc:	Greg Knapp	**Email:**	Sam.Barket@LehighHanson.com
RE:	EMSA Storm Water Runoff Evaluation, Lehigh Permanente Facility		

1.0 INTRODUCTION

Golder Associates (Golder) has prepared this technical memorandum to summarize investigatory activities performed at the Eastern Material Storage Area (EMSA) of Lehigh Southwest Cement Company's Permanente facility located at 24001 Stevens Creek Boulevard and to provide recommendations to reduce selenium in the Pond 30 discharge.

To ascertain potential sources of selenium concentrations associated with the Pond 30 discharge, Lehigh requested Golder to collect runoff samples during storm events at 14 locations in the EMSA on the newly installed non-limestone cover to assess the performance of the cover during the first winter season. The analytical results of those samples indicate the direct runoff from the non-limestone cover overall displays selenium concentrations below 5 µg/L. Repeated sampling at 11 of the locations on the newly-placed cover itself revealed selenium concentrations predominately below 5 µg/L. At three locations on the cover, however, sampling showed concentrations above 5 µg/L. In addition, sampling detected elevated selenium in the swale at the base of the EMSA which directs runoff into Pond 30. The non-limestone cover layer described here is only the first component of the ultimate EMSA cover. An additional layer of revegetation growth media remains to be placed pursuant to the Reclamation Plan.

This data, combined with an evaluation of topographic maps and field observations, suggest net infiltration and subsequent discharge of precipitation as seepage may be contributing to the concentration of selenium in certain areas. Golder recommends additional improvements to the EMSA water management system, such as lining Pond 30 and the drainage swale prior to the upcoming 2016/2017 wet season, to improve the water quality of the Pond 30 discharge.

2.0 EMSA SAMPLING & EVALUATION

In March 2016, Golder collected up to four rounds of samples from 14 different locations within the EMSA's non-limestone cover, and three locations along the Pond 30 swale, as noted on Figure 1, for a total of 48 individual samples. All samples on the non-limestone cover were collected on the surface of the non-

Golder Associates Inc.
425 Lakeside Drive
Sunnyvale, CA 94085 USA
Tel: (408) 220-9223 Fax: (408) 220-9224 www.golder.com

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limestone rock placed in 2015. The final growth-medium and vegetative layer that is the next stage in the reclamation process has not been placed to date.

2.1 Sampling Procedure

Under the direction of a California Professional Geologist, field staff collected 48 surface water samples on field dates that coincided with significant rainfall events. The daily precipitation totals for March are listed on Table 1. The first two rounds of samples consisted of sample locations EC-11 through EC-17, which were sampled on March 6 and 7, 2016. Golder collected the samples during a three-day period of rainfall starting on March 5, 2016 that totaled 4.5 inches. Golder did not collect samples on March 5, 2016 because no significant runoff or accumulation of runoff was evident on the EMSA cover. Additional rainfall of 2.8 inches the following week prompted two more rounds of sampling, which Golder completed on March 11 and 13, 2016. For the last two rounds, the sampling effort was expanded to also include EC-18 through EC-24 and three samples from the storm water drainage swale that runs to Pond 30 (P-30 Swale Entry, P-30 Swale West, and P-30 Swale East).

During the rain events, Golder inspected the EMSA for runoff and/or sheet flow to target these areas for sampling. Rainfall appeared to readily infiltrate the EMSA material in locations where no significant runoff or sheet flow was observed by field staff during the storm events. For several of the sample locations (e.g., EC-22) samples were collected of water that accumulated on the cover material. Samples were also collected from water that appeared to be emanating as seeps from the toe of the EMSA slopes (e.g., EC-16). The type of sample is noted on Table 2.

Samples were collected in accordance with Golder's Standard Operating Procedures and transported to a certified analytical laboratory in a chilled cooler under chain of custody documentation. A dedicated plastic scoop was used to collect water samples. Golder then transferred the samples to laboratory supplied sample bottles preserved with nitric acid. The laboratory analyzed the samples for total selenium via EPA Method 200.8.

2.2 Sampling Results

The results of the sampling events are included on Table 2 and illustrated on Figure 1. Photographs of sampling locations are included in Appendix A. Consistently low levels of selenium below 5 µg/L were detected in samples of water that accumulated on the cover material, considered representative of direct surface runoff. Four samples, EC-11 EC-13, EC-15, and EC-16, were collected along the toe of the upper EMSA fill slope, but above the main EMSA haul road (Figure 1). These samples are considered more representative of seeps emanating from the toe of the slopes than direct runoff of the cover material. Elevated selenium concentrations were observed at three of these sample locations (EC-13, EC-15, and EC-16).

Two rounds of samples were collected from the drainage swale that leads to Pond 30. The drainage swale is part of the main drainage that conveys storm water to Pond 30 from throughout the EMSA. The upgradient drainage swale sample (P-30 Swale Entry) exhibited lower concentrations than the two downgradient swale samples (P-30 Swale West and P-30 Swale East). This suggests that higher selenium containing water is entering the drainage swale downgradient of the P-30 Swale Entry sample location and further down the channel by the P-30 Swale West and East sample locations. The P-30 Swale West and East sample locations are along the drainage swale directly downgradient of a former cut bench at the toe of the low hills that the EMSA was founded on.

2.3 Topographic Map Evaluation and Field Observations

Golder reviewed the 2015 topographic map of the EMSA, representing the current EMSA configuration, to evaluate sub-drainage basin limits and likely flow paths of storm water runoff with respect to the sample locations (Figure 2). Based on the drainage map, runoff from direct precipitation to the EMSA cover is expected to coalesce in each sub-drainage basin and flow to the drainage swale along the north side of the main haul road. However, field observations during storm events indicated that channelized or sheet flow on the cover was limited and that little surface flow was evident in the drainage swales along the haul roads. Additionally, the soils and colluvium that comprise the original ground surface may have a significantly lower permeability than the overlying EMSA overburden material. Based on the observations made by Golder field staff, storm water may infiltrate certain areas of the non-limestone cover, contact the less-permeable original ground surface, and emerge as seeps at the base of certain EMSA slopes. This view is generally supported by mapping of the 2007 ground surface, which indicates subsurface drainage paths in the vicinity of certain seeps (Figure 3). Notably, field staff inspected areas surrounding and directly upgradient of the sampling points EC-13, EC-15, and EC-16 on April 8, 2016 and found minimal (<2%) limestone present.

3.0 SUMMARY

Low levels of selenium below 5 µg/L were detected in the majority of the samples collected from ponding or limited runoff on or directly from the cover. Results from the EMSA sampling suggest that elevated selenium concentrations are confined to specific areas along the bases of certain slopes. It appears that rainfall percolates into the overburden material in some areas, moves downward through the overburden material until it encounters less-permeable materials, and then emerges downslope as seepage.

4.0 RECOMMENDATIONS

Lehigh has requested that Golder provide recommendations for reducing selenium concentrations in the Pond 30 discharge, with an emphasis on measures that can be accomplished during the 2016 dry season before the onset of 2016/2017 rains. Golder recommends the following actions.

4.1 Line Pond 30 and Pond 30 Drainage Swale

Golder recommends lining Pond 30 and the drainage swale directly upgradient of Pond 30 to allow for the effective conveyance of storm water and eliminate seepage. A geomembrane or concrete liner will reduce seepage in and out of the pond and the drainage swale and will allow for easier maintenance and removal of sediments that accumulate within the pond throughout the wet season. The accumulated sediments may partially be comprised of limestone; therefore, routine sediment removal will help reduce the residence time that any water stored within Pond 30 is in contact with potentially limestone-containing sediments.

The type of liner to be used will be evaluated further during the design phase. One potential option will consist of a geomembrane-lined swale and pond combined with a concrete access ramp and sump in the pond to facilitate sediment removal.

4.2 Construct Drainage Trench

In concert with lining Pond 30 and the drainage swale, we recommend that the seepage emerging from the toe of the slope directly upgradient of Pond 30 is diverted to prevent it from entering the Pond 30 conveyance system. This could be achieved by constructing a trench or “French drain” between the toe of the slope and the Pond 30 swale area to collect any seepage along this bench (Figure 2). The trench would be approximately 300 feet long, 3 feet wide, and 5 feet deep and backfilled with coarse material. A vertical riser will be installed in the drain with a submersible pump and float valve to facilitate management of the collected water. The collected water could be pumped to a holding tank and emptied as needed by a water truck or it could be conveyed to the cement plant reclaim water system.

Additional trenches and collection systems may be considered at the other seepage areas identified with elevated selenium located north of the existing main haul road (e.g., EC-13, EC-15, and EC-16) pending the effectiveness of the trench directly upgradient of the Pond 30 drainage swale.

4.3 Manage Pond 30 Water

Golder recommends that Lehigh remove water that accumulates in Pond 30 between rain events during the wet season, where feasible based on weather conditions and breaks between anticipated storm systems. This will allow for access to Pond 30 to perform routine maintenance activities, including sediment removal, and reduce the residence time that water remains in contact with potentially limestone-containing sediment. The method of removal would depend on the quality of water present in Pond 30. Where representative sampling demonstrates that water is acceptable for discharge to Permanente Creek, water in the pond will be pumped out via the discharge pipe through outfall 006. Where sampling reveals water quality that is not acceptable for discharge to Permanente Creek, water will be transferred to water trucks and delivered to the Reclaim Water System. Samples would be tested on an expedited basis.

4.4 Manage Storm Water Run-on

Lehigh made improvements during the 2015/2016 wet season to divert storm water run-on from upgradient facility areas outside of the EMSA boundary from entering the EMSA drainage area. Golder recommends that these improvements are reviewed and inspected to ensure they are functioning as intended throughout the 2016/2017 wet season. If deemed necessary from the inspections, additional improvements will be made to divert potential run-on from entering the EMSA drainage area.

4.5 Evaluate Performance

Golder recommends performing ongoing sampling, testing and monitoring during the 2016/2017 wet season, and comparison to this year's results, to evaluate the effectiveness of the proposed improvements listed above. It is expected that these measures will result in improvement in the quality of any Pond 30 discharges, from improved management of seeps and the expectation that the recently-placed cover material will become less permeable over time as voids fill with finer materials. Further improvement can be expected as well after placement of the vegetative growth layer on top of the non-limestone cover. Based on this evaluation and if deemed necessary, recommendations for future actions will be proposed prior to placing the final growth medium and vegetative layer pursuant to the Reclamation Plan.

Attachments:

Figure 1 – EMSA Selenium Concentrations 2016
Figure 2 – EMSA Sampling Locations and 2015 Topography
Figure 3 – EMSA Sampling Locations and 2007 Topography
Table 1 – Precipitation Data
Table 2 – EMSA Total Selenium Results
Attachment A – EMSA Sampling Location Field Photos
Attachment B – EMSA Field Observation Field Photos

TABLES

Table 1
Precipitation Totals
Lehigh Permanente
March 2016

Date	Precipitation (in)	Temperature Hi	Temperature Low
1	0.01	69.1 °F	52.4 °F
2	0.01	75.3 °F	50.4 °F
3	0	67.6 °F	52 °F
4	0.27	64.6 °F	55.5 °F
5	2.53	60.3 °F	51.8 °F
6	1.32	60.8 °F	46.9 °F
7	0.62	53.8 °F	45.2 °F
8	0.02	59.5 °F	41.8 °F
9	0	70 °F	49.7 °F
10	0.03	69.4 °F	55.5 °F
11	1.2	57.2 °F	45.6 °F
12	0.23	58.6 °F	43.8 °F
13	1.38	58.8 °F	52.6 °F
14	0.02	59.1 °F	44.9 °F
15	0.01	64.8 °F	43.9 °F
16	0.01	70.4 °F	48.1 °F
17	0.02	74.9 °F	51.8 °F
18	0.06	67.7 °F	49.1 °F
19	0.01	70.3 °F	47.4 °F
20	0.04	69.3 °F	47.7 °F
21	0.24	62.3 °F	46.5 °F
22	0.03	61.6 °F	44.2 °F
23	0	65.9 °F	45.9 °F
24	0	68.9 °F	46.1 °F
25	0.03	69.8 °F	46.9 °F
26	0.04	72.4 °F	47.2 °F
27	0	66.6 °F	50.5 °F
28	0	59.1 °F	44.4 °F
29	0.04	62.9 °F	42.1 °F
30	0.01	63.9 °F	42 °F
31	0.02	67.7 °F	47.4 °F

Notes: Data obtained from Cupertino, CA weather station KCACUPER47.

Table 2
EMSA Total Selenium Results
Lehigh Permanente
March 2016

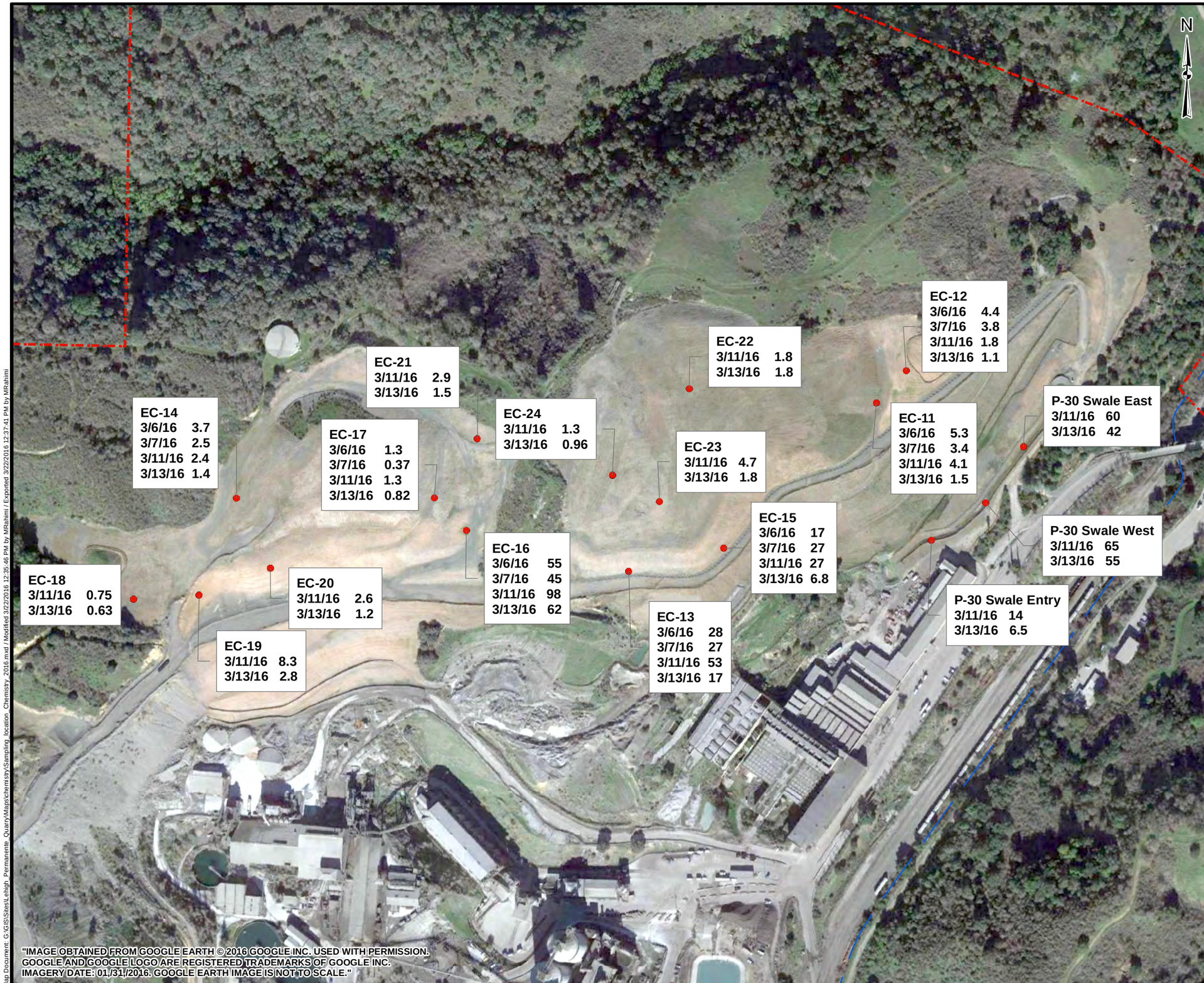
Sample Location	Sample Type	Total Selenium via EPA 200.8	Date Sampled 3/6/16	3/7/16	3/11/16	3/13/16
EC-11	Seep	µg/L	**5.3**	**3.4**	**4.1**	**1.5**
EC-12	Cover	µg/L	**4.4**	**3.8**	**1.8**	**1.1**
EC-13	Seep	µg/L	**28**	**27**	**53**	**17**
EC-14	Cover	µg/L	**3.7**	**2.5**	**2.4**	**1.4**
EC-15	Seep	µg/L	**17**	**27**	**27**	**6.8**
EC-16	Seep	µg/L	**55**	**45**	**98**	**62**
EC-17	Cover	µg/L	**1.3**	**0.37**	**1.3**	**0.82**
EC-18	Cover	µg/L	**NS**	**NS**	**0.75**	**0.63**
EC-19	Cover	µg/L	**NS**	**NS**	**8.3**	**2.8**
EC-20	Cover	µg/L	**NS**	**NS**	**2.6**	**1.2**
EC-21	Cover	µg/L	**NS**	**NS**	**2.9**	**1.5**
EC-22	Cover	µg/L	**NS**	**NS**	**1.8**	**1.8**
EC-23	Cover	µg/L	**NS**	**NS**	**4.7**	**1.8**
EC-24	Cover	µg/L	**NS**	**NS**	**1.3**	**0.96**
P-30 Swale Entry	Seep/Runoff	µg/L	**NS**	**NS**	**14**	**6.5**
P-30 Swale West	Seep/Runoff	µg/L	**NS**	**NS**	**65**	**55**
P-30 Swale East	Seep/Runoff	µg/L	**NS**	**NS**	**60**	**42**

Notes:

µg/L - micrograms per liter (ppb)

NS - not sampled

FIGURES



LEGEND

- Sampling Locations
- Date Selenium(ug/L)
- Property Boundary

300 0 300 Feet

1 in = 300 feet

PROJECT

LEHIGH PERMANENTE
SANTA CLARA COUNTY, CA

TITLE

EMSA SELENIUM CONCENTRATIONS 2016

Golder Associates

PROJECT No.	01655230		FILE No. Sampling_location_Chemistry_2016.mxd	
DESIGN	MM	4/2/2013	SCALE: 1:3,600	REV. 0
GIS	MR	3/22/2016		
CHECK	GW	3/22/2016		
REVIEW	GW	3/22/2016		

FIGURE 1

Map Document: G:\GIS\Sites\Lehigh_Permanente_Quarry\Maps\chemistry\Sampling_location_Chemistry_2016.mxd / Modified 3/22/2016 12:35:46 PM by MRahimi / Exported 3/22/2016 12:37:41 PM by MRahimi

LEGEND

SURFACE WATER WATERSHED

EC-22 SAMPLE LOCATION

0 100 200
1" = 100' FEET

CLIENT
LEHIGH PERMANENTE
SANTA CLARA COUNTY, CALIFORNIA

PROJECT
EMSA Storm Water Runoff Evaluation

CONSULTANT

Golder Associates

YYYY-MM-DD	2014-11-07
DESIGNED	MBR
PREPARED	MBR
REVIEWED	JL
APPROVED	GW

TITLE
EMSA SAMPLING LOCATIONS AND 2015 TOPOGRAPHY

PROJECT NO.	REV.	FIGURE
16655230	A	2

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1 in
0

LEGEND

RUNOFF FLOW PATH

EC-22 SAMPLE LOCATION

0 100 200
1" = 100' FEET

CLIENT
LEHIGH PERMANENTE
SANTA CLARA COUNTY, CALIFORNIA

CONSULTANT

Golder Associates

YYYY-MM-DD	2016-05-09
DESIGNED	MRB
PREPARED	MBR
REVIEWED	JL
APPROVED	GW

PROJECT
EMSA Storm Water Runoff Evaluation

TITLE
EMSA SAMPLING LOCATIONS AND 2007 TOPOGRAPHY

PROJECT NO. 16655230 | REV. A | FIGURE 3

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ATTACHMENT A

PHOTO A1: EC-11

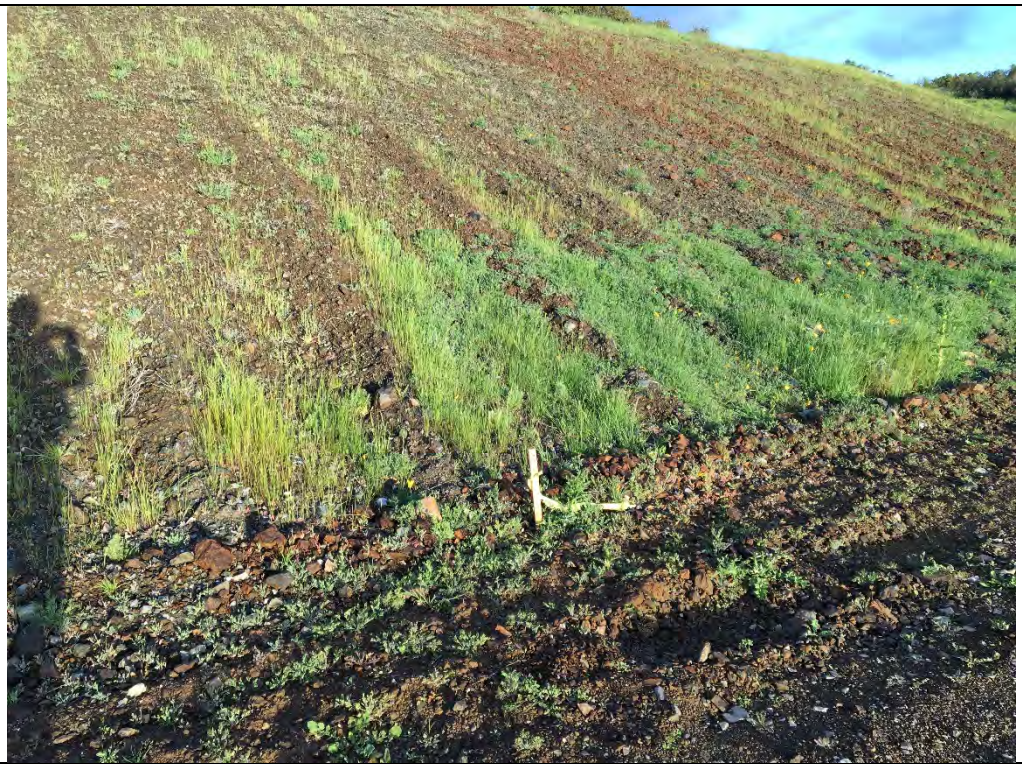

PHOTO A2: EC-12

PHOTO A3: EC-13

PHOTO A4: EC-14

PHOTO A5: EC-15

PHOTO A6: EC-16

PHOTO A7: EC-17

PHOTO A8: EC-18

PHOTO A9: EC-19

PHOTO A10: EC-20

PHOTO A11: EC-21

PHOTO A12: EC-22

PHOTO A13: EC-23

PHOTO A14: EC-24

PHOTO A15: P-30 SWALE ENTRY

PHOTO A16: P-30 SWALE WEST

PHOTO A17: P-30 SWALE EAST

ATTACHMENT B

PHOTO B1: WATER ACCUMULATION AT EC-16

PHOTO B2: EMSA SURFACE MATERIAL

PHOTO B3: EC-15 AND HAUL ROAD DRAINAGE SWALE

PHOTO B4: EC-13 AND HAUL ROAD DRAINAGE SWALE

PHOTO B5: EC-11

PHOTO B6: TOE OF EMSA, ADJACENT TO POND 30 SWALE