

APPENDIX F

**GOLLOB PARK TEMPORARY SOIL GAS PROBE INSTALLATION
AND SAMPLING REPORT, BROADWAY SOUTH LANDFILL
BROADWAY-PANTANO WQARF SITE, LANDFILL OPERABLE UNIT
TUCSON, ARIZONA**

APPENDIX F

GOLLOB PARK TEMPORARY SOIL GAS PROBE INSTALLATION AND SAMPLING REPORT

Broadway South Landfill

Broadway-Pantano WQARF Site

Landfill Operable Unit

Tucson, Arizona

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2013

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2013

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2013

ATTACHMENTS

Attachment F1 Soil Gas Probe Installation Forms – Temporary Probes in Gollob Park

Attachment F2 Soil Vapor Sampling Forms – Temporary Probes in Gollob Park

Attachment F3 Photographs – Installation and Sampling of Temporary Probes in Gollob Park

1.0 INTRODUCTION

This report was prepared by Clear Creek Associates (Clear Creek) as part of the Broadway-Pantano Landfill Operable Unit (LOU) Remedial Investigation (RI) report for the Arizona Department of Environmental Quality (ADEQ) to summarize the installation of four temporary soil gas probes and the collection of soil gas samples from these temporary probes. The temporary probe installation activities, sampling, and analyses were conducted in general accordance with the procedures described in the RI Work Plan (Clear Creek, 2013).

The temporary probes in Gollob Park were installed to:

- Further delineate the extent of landfill material and
- To evaluate whether soil equivalent concentrations¹ of VOCs exceed Arizona Soil Remediation Levels (SRLs) (ADEQ, 2007).
- To compare soil equivalent concentrations with minimum Groundwater Protection Levels (GPLs) (ADEQ, 1996a, revised 2008) to evaluate risk to groundwater.

The drilling, installation, and sampling activities associated with the temporary probes were conducted from February 20, 2013 to February 26, 2013.

¹ Soil gas concentrations were converted to soil concentrations (assuming equilibrium partitioning of the VOCs) to yield “soil equivalent” concentrations, based on a formula in the ADEQ Soil Vapor Sampling Guidance (2011). The dimensionless Henry’s Law constant and the soil organic carbon-water partitioning coefficient, used in the equation, were obtained from USEPA (2013) if not provided in the ADEQ (2011). The soil equivalent concentration was not calculated if the constants for a particular compound were not provided by ADEQ (2011) or USEPA (2013).

2.0 SUMMARY OF FIELD ACTIVITIES

Field activities included drilling, installing, and sampling the temporary soil gas probes located in Gollob Park. Clear Creek provided oversight during the temporary probe drilling and installation, logged the cuttings, and performed the soil gas purging and sampling of the temporary probes. Field activities were documented in field notebooks (Appendix J of this RI report), Soil Gas Probe Installation Forms (Attachment F1), and Soil Vapor Sampling Forms (Attachment F2).

2.1 SITE AND SAMPLING LOCATIONS

Four temporary probes were installed in Gollob Park for the collection of soil gas samples (Figure F1).

2.2 ACCESS

The temporary probes are located at Gollob Park owned by the City of Tucson. Clear Creek staff met with COT staff from the Environmental Services and Parks and Recreation Departments to locate boring locations and agree on a schedule for the work.

2.3 PERMITTING

Drilling permits from the Arizona Department of Water Resources were not required for the temporary soil borings because it was known that groundwater would not be encountered within the shallow intervals penetrated by the boreholes.

Prior to the start of fieldwork, Clear Creek contacted the Pima County Department of Environmental Quality (PDEQ) regarding the need to permit and/or treat soil vapor that would be generated during purging of the soil vapor probes. PDEQ said that based on the very small volume of effluent, there were no permitting or treatment requirements.

2.4 UTILITY CLEARANCE

Prior to installing the temporary probes, Clear Creek surveyed the proposed locations using a Global Positioning System (GPS) enabled device according to ADEQ's Locational Data Policy (ADEQ, 1996b). After the locations were identified and agreed upon by Clear Creek, ADEQ, and the property owners, each location was marked and Blue Stake was contacted to identify utility locations.

2.5 INSTALLATION OF TEMPORARY PROBES

Four temporary probes were installed within Gollob Park to confirm whether or not waste is present in the subsurface. The probes were designated Gollob-2013-1, Gollob-2013-2, Gollob-2013-3, and Gollob-2013-4. The locations of the temporary Gollob Park soil gas probes are shown on Figure F1.

Geomechanics Southwest, Inc. (Geomechanics) was contracted by Clear Creek to perform the drilling of the soil borings and the installation of the temporary soil gas probes. Geomechanics used an AMS 9100 PowerProbe mounted to an ASV SC-50 Scout Utility vehicle to advance 2 3/8-inch outside diameter dual tube drill pipe utilizing a direct push drill method. The boreholes were drilled until the borehole was five feet below the bottom of trash or until the drill string could no longer advance (refusal). The borehole depths ranged from 10 to 25.5 feet below land surface (ft bls). Continuous samples of the material penetrated were collected in acrylic liners and were logged.

Trash and/or demolition debris was encountered in three of the four Gollob Park boreholes (Gollob-2013-1, Gollob-2013-3, and Gollob-2013-4). The boreholes were advanced to one to five feet below the bottom of the trash material before the direct push rig hit refusal. The refusal depths were interpreted to be well-compacted native soil. This interpretation is partially based the push probe rig operator's experience with the response of the equipment and on Clear Creek's review of previous studies regarding the extent of landfilled wastes (as discussed in Section 4.3 of the main text of this LOU RI report). However, the possibility that refusal was due to a large rock or landfill waste cannot be ruled out. After the desired depth was reached, a temporary soil gas probe was constructed.

The four temporary soil gas probes had similar construction. Approximately one foot of silica sand filter pack was installed at the bottom of each borehole. Inert disposable Teflon™ tubing with an outer diameter of 1/4 inch and an attached microfilter sampling tip was emplaced in the middle of the filter pack. One foot of dry Benseal® Wyoming Granular Sodium Bentonite chips was installed on top of the filter pack. A bentonite grout slurry made with 1/4 inch Pel-Plug Bentonite Pellets and water was then installed to a depth of one to six feet bls in the four Gollob Park boreholes. Clean soil and sand were installed from the top of the bentonite slurry to the ground surface. The depth of the annular material was verified with a measuring tape throughout the installation process. A cap was attached to the end of the Teflon™ tubing sticking out of the borehole, and the end of the tubing was placed in a zip lock bag to protect the probe from moisture at the surface. Soil borehole logs and as-built diagrams of the temporary soil gas probes are included in the Soil Gas Probe Installation Forms (Attachment F1).

2.6 PURGING, SOIL GAS SAMPLING, AND ABANDONMENT

2.6.1 Soil Gas Purging

The temporary probes at Gollob Park were purged using a 1/16 Horse Power GAST vacuum pump. During purging, the vacuum, flow rate, estimated purge volume, and other pertinent field observations were monitored and recorded on the Soil Vapor Sampling Form (Attachment F2). In addition, landfill gas

(LFG) (methane, carbon dioxide, and oxygen) concentrations were measured periodically using a Landtec Gem 500 LFG monitor. The LFG monitor was calibrated by the supplier prior to delivery, according to the manufacturer's instructions. The LFG concentrations did not vary significantly during purging, and thus were considered stable and representative of ambient conditions at the time of sample collection. Table F1 shows the LFG concentrations measured just before sample collection. The flow rate and vacuum in the probe and sampling manifold were controlled using a bleed valve installed between the pump and the flow meter. Photographs and a schematic drawing of the sampling system are presented in Attachment F3.

The temporary probes were purged at a rate of 200 to 250 milliliters per minute (ml/min) and had a measured vacuum of 0 inches of water, indicating adequate air flow. In accordance with Section 5.4.1 of the ADEQ (2011) Soil Vapor Sampling Guidance document, three to five internal volumes² of the sample system were purged prior to collection of the soil gas sample. Purging (and sampling) of the temporary probes was performed a minimum of 22 hours after the probe was installed. The Soil Vapor Sampling Forms, which include purge times, rates, vacuum measurements, LFG measurements and other observations are included in Attachment F2.

2.6.2 Soil Gas Sample Collection

After purging, the pump was turned off and the soil gas samples were collected in 1-liter stainless steel SummaTM canisters provided by the laboratory. The laboratory certified that the canisters had been properly cleaned and evacuated prior to shipment. Each canister was used within 30 days of receipt from the laboratory. A dedicated sampling train, consisting of a mechanical vacuum gauge and flow regulator, was provided by the laboratory and connected directly to the SummaTM canister. The pressure inside the stainless steel canister was measured prior to sampling to confirm that the canister arrived from the laboratory with the laboratory-recommended minimum vacuum of -25 inches of mercury. Initial canister vacuum readings were noted on the Soil Vapor Sampling Forms. The dedicated sampling train attached to the SummaTM canister was connected to a tee and valve that was used to isolate the dedicated SummaTM canister and sampling train from the common components of the sampling system. These common components of the sampling system included a sampling manifold, bleed valve, LFG monitor, and

² ADEQ (2011) defines *internal volume* as the *dead volume* plus probe tip sand-pack volume. The dead volume is defined as the volume of the sampling probe and the connected sampling tubing.

vacuum pump. The sampling manifold consisted of a valve, mechanical vacuum gauge, and flow meter. Photographs and a schematic drawing of the sampling systems are included in Attachment F3.

The valve to the sampling manifold was closed prior to the collection of the sample, and the valve on the SummaTM canister was opened to allow the soil gas to flow into the canister. In accordance with ADEQ guidance (2011), the samples were collected at the default flow rate of 200 ml/min or less. The sample collection flow rate was managed by the dedicated flow regulator in the sample train provided by the laboratory. The pressure inside the SummaTM canister was measured and documented after sampling was complete. One soil gas sample was collected from each of the temporary probes in Gollob Park.

A leak test was conducted as soil gas samples were collected. A leak detection gas, 2-propanol (a.k.a. rubbing alcohol), was used to saturate the air space around the sample train by applying it to a towel and placing it around the sampling train connections. To confirm that the sampling train and probe surface seal were tight, samples were analyzed for the leak test compound. If the concentration of the leak check compound was greater than or equal to 10 micrograms per liter ($\mu\text{g/L}$), the results were discussed with the ADEQ Project Manager, and the usability of the data were evaluated during data validation. The 10 $\mu\text{g/L}$ leak detection threshold concentration for 2-propanol was based on procedures used at similar sites in Arizona.

The soil gas sampling from the Gollob Park temporary probes was part of a larger field investigation that included the collection of soil gas samples from temporary and existing probes at the Broadway-Pantano WQARF site. Duplicate samples were collected for Quality Assurance/Quality Control (QA/QC) purposes in accordance with the procedures described in Appendix B of the RI Work Plan (Clear Creek, 2013). The number of duplicate soil gas samples collected from the probes during this LOU RI investigation was approximately 10 percent of the total number of samples. A minimum of one duplicate sample was collected from each sample delivery group sent to the lab. A duplicate sample was not collected from Gollob Park temporary probes.

2.6.3 Analyses

Samples were submitted to ESC Lab Sciences for analysis of VOCs according to the RI Work Plan (Clear Creek, 2013). Sample shipments were accompanied by chain-of-custody documentation. Self-adhesive custody seals were placed across the lid of each box that was shipped to the lab. ESC analyzed the soil gas samples for tetrachloroethylene (PCE), trichloroethylene (TCE), vinyl chloride, and other VOCs (including the leak detection compound, 2-propanol) by Environmental Protection Agency (EPA) Method TO-15.

2.6.4 Abandonment of Temporary Probes

The temporary probes installed in Gollob Park for this investigation were abandoned after the soil gas samples were collected, as requested by the property owner. The probes were abandoned by pulling out the implanted tubing and smoothing the site over with the adjacent soil and/or sod.

2.7 INVESTIGATION-DERIVED WASTE HANDLING

Due to the direct push drill method used to install the temporary probes, minimal amounts of investigation-derived waste (IDW) were generated. IDW consisted of soil and soil/landfill waste generated during direct push drilling, disposable gloves, and acrylic liners from the direct push sampling probes.

Gloves, acrylic liners, and other non-soil wastes were collected in garbage bags and disposed of as trash. Soils and landfill wastes from Gollob Park probes were removed from the park for disposal at the BSL with the other BSL probe material.

3.0 SUMMARY OF INVESTIGATION RESULTS

3.1 WASTE DELINEATION IN GOLLOB PARK

Trash and/or demolition debris was encountered in three of the four new Gollob Park boreholes. Landfilled material was observed to be 8.5 feet thick in Gollob-2013-1 (from 8.5 to 17 feet bls), one foot thick in Gollob-2013-3 (from 8 to 9 feet bls), and 8.3 feet thick in Gollob-2013-4 (from 11.7 to 20 feet bls). No landfilled material was observed in Gollob-2013-2, though an oily sand layer less than a 1/2-foot thick was observed. The soil cover and waste thicknesses for the four boreholes are depicted in Figure F1. The soil borehole logs for these new temporary probes were used in conjunction with previous studies (as discussed in the main text of this RI report) to help delineate the extent of landfilled material in Gollob Park. The updated waste delineation of the Broadway South Landfill is shown on Figure 23 of the RI report. The soil boring logs are shown on the Soil Gas Probe Installation Forms in Attachment F1.

3.2 SOIL GAS ANALYTICAL RESULTS

Soil gas samples were collected from the four Gollob Park temporary probes. The probes were completed at different depths as follows:

GOLLOB-2013-1 had a sample depth of 18 ft bls,

GOLLOB-2013-2 had a sample depth of 10 ft bls,

GOLLOB-2013-3 had a sample depth of 8.7 ft bls,

GOLLOB-2013-4 had a sample depth of 22.5 ft bls.

3.2.1 Landfill Gas

Concentrations of LFG measured prior to sample collection are provided in Table F1. The oxygen concentrations in the Gollob Park probes ranged from 14.5% to 22.2%. The methane concentrations ranged from 0.0% to 0.8%. The carbon dioxide concentrations ranged from 0.3% to 6.5%. The highest concentration of methane was measured from probes GOLLOB-2013-1 and GOLLOB-2013-4. The highest concentration of carbon dioxide and the lowest concentration of oxygen were measured from probe GOLLOB-2013-4.

3.2.2 VOCs

Four soil gas samples were collected from the temporary probes in Gollob Park. Laboratory analyses were performed within the 30 days holding time for TO-15 analysis of the Summa™ canisters. As specified in the RI Work Plan (Clear Creek, 2013), ESC Lab Sciences analyzed the soil gas samples for tetrachloroethylene (PCE), trichloroethylene (TCE), vinyl chloride, and other VOCs (including the leak detection gas, 2-propanol) by EPA Method TO-15.

A complete list of parameters analyzed along with the analytical results is presented in Table F2. Twenty-one of the 38 VOCs analyzed were detected in one or more of the Gollob Park temporary probe soil gas samples. A Detection Summary is presented on Table F3.

The maximum concentration detected for each analyte, the equivalent soil concentration (calculated according to ADEQ, 2011), the Arizona Soil Remediation Levels (ADEQ, 2007), and the minimum Groundwater Protection Levels (ADEQ, 1996a rev. 2008) are presented in Table F2. In Table F2, the soil equivalent concentration of the maximum soil gas concentration for each analyte can be compared with the most stringent SRL and with the minimum GPL, if one has been established. None of the soil equivalent concentrations exceeded either level. A discussion of specific chemicals is provided below.

3.2.2.1 PCE

PCE was detected in three of the four Gollob Park temporary probe samples at concentrations above the laboratory reporting limits. The highest soil gas PCE concentration was 3.9 milligrams per cubic meter (mg/m^3) (or micrograms per liter [$\mu\text{g}/\text{L}$]) in GOLLOB-2013-2 from a depth of 10 feet bls. Using the dimensionless Henry's Law constant, the soil equivalent concentration of the highest soil gas PCE concentration is 0.006065 milligrams per kilogram (mg/kg). This soil equivalent concentration is less than the minimum GPL of 0.80 mg/kg and the most stringent SRL of 0.51 mg/kg .

3.2.2.2 TCE

TCE was detected in three of the four Gollob Park temporary probe samples at concentrations above the laboratory reporting limits. The detected concentration of soil gas TCE (3.6 mg/m^3 or $\mu\text{g}/\text{L}$) was from GOLLOB-2013-2 from a depth of 10 feet bls. The soil equivalent concentration of the detected soil gas TCE concentration is 0.010022 mg/kg . This is less than the minimum GPL of 0.76 mg/kg and the most stringent SRL of 3.0 mg/kg .

3.2.2.3 Vinyl Chloride

Vinyl chloride (VC) was detected in two of the four Gollob Park temporary probe samples at concentrations above the laboratory reporting limits. The highest VC concentration was 0.089 mg/m³ in GOLLOB-2013-4 from a depth of 22.5 feet. The soil equivalent concentration of the detected soil gas VC concentration is 0.000034 mg/kg. This is below the most stringent SRL of 0.085 mg/kg. ADEQ has not set a minimum GPL for VC.

4.0 RESULTS OF DATA VALIDATION

Clear Creek contracted Innovative Technical Solutions, Inc. (ITSI) to conduct data validation according to USEPA guidance (USEPA, 2008) and according to the Quality Assurance Project Plan in the RI Work Plan (Clear Creek, 2013). The data validation included review of reports from the laboratory equivalent to EPA Level III data deliverables, which include sample results, chain-of-custody forms, basic quality control summaries including surrogate recoveries, method blank results, and precision and accuracy data summaries for the sample preparation batch. Fourteen soil gas samples of the 150 soil gas samples collected by Clear Creek for the LOU RI underwent full data validation for which the laboratory provided a level IV data deliverable. Full data validation included all of the items listed above plus a review of the data for instrument calibrations, sample quantitation, compound identification and internal standard recoveries and raw data.

The laboratory reports and chain-of-custody documentation are in Appendix H of this RI report. The Data Validation Report is in Appendix I.

Relevant data validation results for the Gollob Park probe samples are:

- The sample delivery group that included Gollob-2013-04 had a surrogate percent recovery for bromofluorobenzene of 134.75 percent, which is outside of the 70 to 130 percent criteria. The associated positive results have been qualified as “J+” for an estimated value with a high bias.
- Detections of the leak detection compound, 2-propanol, were less than the 4,069 parts per billion by volume (ppbv) (or 10 mg/m³) criteria. No results were flagged for exceeding this criterion.

The data, as qualified, are useable for their intended purpose of evaluating risk assessment and soil quality.

5.0 REFERENCES

- Arizona Department of Environmental Quality (ADEQ), 1996a, rev. 2008. A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, September 1996. Minimum GPLs were revised in 2008 using 2007 chemical properties.
- Arizona Department of Environmental Quality (ADEQ), 1996b. Locational Data Policy. Issue Date February 3, 1995; amended November 13, 1996.
- Arizona Department of Environmental Quality (ADEQ), 2007. Title 18 Environmental Quality, Chapter 7 Department of Environmental Quality Remedial Action, Supp. 09-1, Issue Date March 29, 1996; amended 13 A.A.R. 971 effective. May 5, 2007.
http://www.azsos.gov/public_services/title_18/18-07.htm
- Arizona Department of Environmental Quality (ADEQ), 2011. Soil Vapor Sampling Guidance. July 10, 2008 (Revised May 19, 2011).
- Clear Creek Associates (Clear Creek), 2013, Remedial Investigation Work Plan, Broadway-Pantano WQARF Site Landfill Operable Unit, Tucson, Arizona, Prepared for Arizona Department of Environmental Quality, February 1, 2013.
- USEPA, 2008. Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review, EPA-540-R-08-01. June 2008.

APPENDIX F

FIGURE



Legend

- Temp. Soil Gas Probe
[Cover Thickness (ft.) /
Refuse Thickness (ft.)]

— Extent of Refuse*

▨ Estimated Extent of
Refuse Removed**

Notes:

*Refuse was reported to have been removed at Hilton, Culver's, and Broadway Proper prior to construction of the buildings. The areas of removal were not documented. The "Extent of Refuse" boundary is dashed in areas where removal may have occurred.

**Estimated extent of refuse removed during construction operations at Broadway Proper (Brinsko, 1989).

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

0 300
Feet
1 inch:300 feet

Map Projection:
NAD 1983 UTM Zone 12N



Job No. 233005

Revision: A

**CLEAR
CREEK
ASSOCIATES**

**Figure F1 - Shallow Temporary
Soil Gas Probe Locations
Gollob Park
Broadway South Landfill**

APPENDIX F
TABLES

Table F1
Landfill Gas Concentrations
Gollob Park Temporary Probes
Broadway South Landfill 2013

Sample Point ID	Date	Methane (% by volume)	Carbon Dioxide (% by volume)	Oxygen (% by volume)
GOLLOB-2013-1	02/22/2013	0.8	3.0	17.7
GOLLOB-2013-2	02/22/2013	0.4	0.3	22.2
GOLLOB-2013-3	02/22/2013	0.0	2.3	19.0
GOLLOB-2013-4	02/26/2013	0.8	6.5	14.5

Notes:

% - percentage by volume measured during soil gas purge

Sample ID (GOLLOB-2013-1) = probe ID (GOLLOB-2013-1). The depth of the probe is NOT included in the sample ID.

Table F2
Soil Gas Analytical Results
Gollob Park Temporary Probes
Broadway South Landfill 2013

Location ID				GOLLOB-2013-1		GOLLOB-2013-2		GOLLOB-2013-3		GOLLOB-2013-4		Max Soil Gas Result (mg/m³)	Max Soil Gas Result Location	Soil Equivalent of Max Soil Gas Result ₂ (mg/kg)	Soil Remediation Levels ₃					Minimum GPL ₄ (mg/kg)
Sample ID ₁				GOLLOB-2013-1-18		GOLLOB-2013-2-10		GOLLOB-2013-3-8.7		GOLLOB-2013-4-22.5					Residential SRL			Non-Residential SRL (mg/kg)		
Latitude (Degrees)				32°12'51.61"N		32°12'51.82"N		32°12'54.71"N		32°12'54.61"N					Carcinogen	Non-Carcinogen (mg/kg)				
Longitude (Degrees)				110°49'48.54"W		110°49'50.10"W		110°49'49.71"W		110°49'47.01"W										
Collect Date				2/22/2013		2/22/2013		2/22/2013		2/26/2013										
Method	CAS No.	Parameter	Units	Value	Qual	Value	Qual	Value	Qual	Value	Qual									
TO-15	71-43-2	Benzene	mg/m³	0.042		0.24		<0.00128		0.11		0.24	GOLLOB-2013-2	0.00052	0.65	NA		1.4	0.7	
TO-15	74-83-9	Bromomethane	mg/m³	<0.0124		<0.00311		<0.00155		<0.0155		ND					3.9	13.0		
TO-15	56-23-5	Carbon tetrachloride	mg/m³	<0.0202		<0.00504		<0.00252		<0.0252		ND			0.25	2.5	2.2	5.5	0.95	
TO-15	108-90-7	Chlorobenzene	mg/m³	<0.0148		<0.00370		<0.00185		<0.0185		ND					150	530.0	16.5	
TO-15	75-00-3	Chloroethane	mg/m³	<0.00844		<0.00211		<0.00106		<0.0106		ND			3.0	30		65.0		
TO-15	67-66-3	Chloroform	mg/m³	<0.0156		0.036		0.025		<0.0195		0.036	GOLLOB-2013-2	0.000088	0.94	9.4		20.0		
TO-15	74-87-3	Chloromethane	mg/m³	<0.00661		<0.00165		<0.000826		<0.00826		ND					48	160.0		
TO-15	106-93-4	1,2-Dibromoethane	mg/m³	<0.0246		<0.00615		<0.00308		<0.0308		ND			0.029	0.29		0.63		
TO-15	95-50-1	1,2-Dichlorobenzene	mg/m³	<0.0192		<0.00481		<0.00240		<0.0240		ND					600*	600*	116***	
TO-15	541-73-1	1,3-Dichlorobenzene	mg/m³	<0.0192		<0.00481		<0.00240		<0.0240		ND					530	600*		
TO-15	106-46-7	1,4-Dichlorobenzene	mg/m³	<0.0192		0.038		<0.00240		<0.0240		0.038	GOLLOB-2013-2	0.00091	3.5	35		79.0	27.0	
TO-15	107-06-2	1,2-Dichloroethane	mg/m³	<0.0130		<0.00324		<0.00162		<0.0162		ND			0.28	2.8		6.0	0.2	
TO-15	75-34-3	1,1-Dichloroethane	mg/m³	<0.0128		0.0034		<0.00160		<0.0160		0.0034	GOLLOB-2013-2	0.000005			510	1,700*	0.85	
TO-15	75-34-4	1,1-Dichloroethene	mg/m³	<0.0127		0.024		<0.00159		<0.0159		0.024	GOLLOB-2013-2	0.000015			120	410		
TO-15	156-59-2	cis-1,2-Dichloroethene	mg/m³	0.034		0.27		<0.00159		0.75		0.75	GOLLOB-2013-4	0.00155			43	150	5.3	
TO-15	156-60-5	trans-1,2-Dichloroethene	mg/m³	<0.0127		0.11		<0.00159		<0.0159		0.11	GOLLOB-2013-2	0.00014			69	230	9.2	
TO-15	78-87-5	1,2-Dichloropropane	mg/m³	<0.0148		0.04		<0.00185		<0.0185		0.04	GOLLOB-2013-2	0.00013	0.34	3.4		7.4	0.36	
TO-15	10061-01-5	cis-1,3-Dichloropropene	mg/m³	<0.0145		<0.00363		<0.00182		<0.0182		ND						18**		
TO-15	10061-02-6	trans-1,3-Dichloropropene	mg/m³	<0.0145		<0.00363		<0.00182		<0.0182		ND			0.79**	7.9**				
TO-15	100-41-4	Ethylbenzene	mg/m³	0.014		<0.00347		<0.00173		0.061		0.061	GOLLOB-2013-4	0.00044			400*	400*	82***	
TO-15	76-13-1	1,1,2-Trichlorotrifluoroethane- Freon 113	mg/m³	<0.0245		<0.00613		<0.00307		<0.0307		ND					5,600*	5,600*		
TO-15	75-69-4	Trichlorofluoromethane- Freon 11	mg/m³	<0.0180		1.2		<0.00225		<0.0225		1.2	GOLLOB-2013-2	0.00033			390	1,300		
TO-15	75-71-8	Dichlorodifluoromethane- Freon 12	mg/m³	0.026		5.9		0.0039		0.047		5.9	GOLLOB-2013-2	0.00125			94	310		
TO-15	76-14-2	1,2-Dichlorotetrafluoroethane- Freon 114	mg/m³	0.051		4.2		0.0047		0.066		4.2	GOLLOB-2013-2	0.00097						
TO-15	87-68-3	Hexachloro-1,3-butadiene	mg/m³	<0.108		<0.0269		<0.0135		<0.135		ND			7.0	70	18	180		
TO-15	75-09-2	Methylene Chloride	mg/m³	<0.0111		0.16		<0.00139		0.019		0.16	GOLLOB-2013-2	0.00033	9.3	93		210		
TO-15	100-42-5	Styrene	mg/m³	<0.0136		0.0047		<0.00170		0.02		0.02	GOLLOB-2013-4	0.00085			1,500*	1,500*	45	
TO-15	79-34-5	1,1,2,2-Tetrachloroethane	mg/m³	<0.0220		<0.00550		<0.00275		<0.0275		ND			0.42	4.2		9.3		
TO-15	127-18-4	Tetrachloroethylene (PCE)	mg/m³	0.029		3.9		0.014		<0.0272		3.9	GOLLOB-2013-2	0.00606	0.51	5.1		13	0.8	
TO-15	108-88-3	Toluene	mg/m³	0.012		0.033		0.0021		0.083		0.083	GOLLOB-2013-4	0.00038			650*	650*	159***	
TO-15	120-82-1	1,2,4-Trichlorobenzene	mg/m³	<0.0748		<0.0187		<0.00933		<0.0933		ND					62	220		
TO-15	71-55-6	1,1,1-Trichloroethane	mg/m³	<0.0174		<0.00435		<0.00218		<0.0218		ND					1,200*	1,200*	0.94	
TO-15	79-00-5	1,1,2-Trichloroethane	mg/m³	<0.0174		<0.00435		<0.00218		<0.0218		ND			0.74	7.4		16		
TO-15	79-01-6	Trichloroethylene (TCE)	mg/m³	0.03		3.6		<0.00214		0.054		3.6	GOLLOB-2013-2	0.0100	3.0	30	17	65	0.76	
TO-15	95-63-6	1,2,4-Trimethylbenzene	mg/m³	<0.0157		0.027		<0.00196		<0.0196		0.027	GOLLOB-2013-2	0.00264			52	170		
TO-15	108-67-8	1,3,5-Trimethylbenzene	mg/m³	<0.0157		0.018		<0.00196		<0.0196		0.018	GOLLOB-2013-2	0.00029			21	70		
TO-15	75-01-4	Vinyl chloride (VC)	mg/m³	<0.00818		0.024		<0.00102		0.089		0.089	GOLLOB-2013-4	0.000034	0.085	NA		0.75		
TO-15	1330-20-7	Xylenes, Total	mg/m³	<0.0417		0.12		<0.00521		0.14		0.14	GOLLOB-2013-4	0.00125			270	420*	31***	
TO-15	67-63-0	2-Propanol ₅	mg/m³	<0.0492		0.019	J	<0.00615	J	<0.0615		0.019	GOLLOB-2013-2	NA						

Notes:

mg/m ³	milligrams per meter cubed
mg/kg	milligrams per kilogram
DUP	Duplicate sample
NA	Not applicable
ND	Analyte not detected above reporting limit
NS	Not sampled
UNK	Depth unknown
WH	Wellhead
SRL	Soil Remediation Level
GPL	Groundwater Protection Level
Qual	Qualifier

Shaded cell indicates detection

There may be a slight discrepancy between the reported value in the laboratory report and the reported value in the data validator's report due to a conversion of units (from parts per billion to mg/m³). These values are very small and do not result in any substantive difference relative to SRLs.

Notes continued:

- 1 Sample ID (GOLLOB-2013-1) = probe ID (GOLLOB-2013-1). The depth of the probe is NOT included in the sample ID.
 - 2 Calculated according to ADEQ (2011) guidance. Constants for chemical properties were obtained from USEPA (2013) if not provided by ADEQ (2011). Soil equivalents were not calculated if constants were not provided by ADEQ (2011) or U
 - 3 Soil Remediation Levels, Arizona Administrative Code Title 18, Article 2, Effective as May 5, 2007- http://www.azsos.gov/public_services/title_18/18-07.htm.
 - 4 Groundwater Protection Levels, Arizona Department of Environmental Quality, A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, September 1996, VOCs revised 2008.
 - 5 2-Propanol was used as the leak detection compound.
 - * Indicates SRL is based on the chemical-specific saturation level in soil for volatile organic chemicals only.
 - ** Based on SRL for CAS 542-75-6.
 - *** Indicates GPL based upon saturation limit.
- Qualifiers:
- J Estimated: The analyte was positively identified, the quantitation is an estimation due to discrepancies in meeting certain analyte-specific quality control criteria.
- U Undetected: The analyte was analyzed for, but not detected
- UJ The analyte was not detected; however, the result is estimated due to discrepancies in meeting certain analyte-specific quality control criteria.
- B (EPA) - The indicated compound was found in the associated method blank as well as the laboratory sample.
- B3 (ESC) - The indicated compound was found in the associated method blank, but all reported samples were non-detect.
- (-) Indicates a low bias.
- (+) Indicates a high bias.
- < Less than laboratory reporting limit.

Table F3
Detection Summary - Temporary Soil Gas Probes
Gollob Park - Broadway South Landfill 2013

Compound	Samples Analyzed	Number of Detections > RL	Feb-Mar 2013 Maximum Concentration (mg/m ³)	Feb-Mar 2013 Location of Maximum Concentration
Benzene	4	3	0.24	GOLLOB-2013-2
Bromomethane	4	0	ND	
Carbon tetrachloride	4	0	ND	
Chlorobenzene	4	0	ND	
Chloroethane	4	0	ND	
Chloroform	4	2	0.036	GOLLOB-2013-2
Chloromethane	4	0	ND	
1,2-Dibromoethane	4	0	ND	
1,2-Dichlorobenzene	4	0	ND	
1,3-Dichlorobenzene	4	0	ND	
1,4-Dichlorobenzene	4	1	0.038	GOLLOB-2013-2
1,2-Dichloroethane	4	0	ND	
1,1-Dichloroethane	4	1	0.0034	GOLLOB-2013-2
1,1-Dichloroethene	4	1	0.024	GOLLOB-2013-2
cis-1,2-Dichloroethene	4	3	0.75	GOLLOB-2013-4
trans-1,2-Dichloroethene	4	1	0.11	GOLLOB-2013-2
1,2-Dichloropropane	4	1	0.04	GOLLOB-2013-2
cis-1,3-Dichloropropene	4	0	ND	
trans-1,3-Dichloropropene	4	0	ND	
Ethylbenzene	4	2	0.061	GOLLOB-2013-4
1,1,2-Trichlorotrifluoroethane	4	0	ND	
Trichlorofluoromethane	4	1	1.2	GOLLOB-2013-2
Dichlorodifluoromethane	4	4	5.9	GOLLOB-2013-2
1,2-Dichlorotetrafluoroethane	4	4	4.2	GOLLOB-2013-2
Hexachloro-1,3-butadiene	4	0	ND	
Methylene Chloride	4	2	0.16	GOLLOB-2013-2
Styrene	4	2	0.02	GOLLOB-2013-4
1,1,2,2-Tetrachloroethane	4	0	ND	
Tetrachloroethylene (PCE)	4	3	3.9	GOLLOB-2013-2
Toluene	4	4	0.083	GOLLOB-2013-4
1,2,4-Trichlorobenzene	4	0	ND	
1,1,1-Trichloroethane	4	0	ND	
1,1,2-Trichloroethane	4	0	ND	
Trichloroethylene (TCE)	4	3	3.6	GOLLOB-2013-2
1,2,4-Trimethylbenzene	4	2	0.027	GOLLOB-2013-2
1,3,5-Trimethylbenzene	4	1	0.018	GOLLOB-2013-2
Vinyl chloride (VC)	4	2	0.089	GOLLOB-2013-4
Xylenes, Total	4	2	0.14	GOLLOB-2013-4

Notes:

mg/m³ - milligrams per meter cubed

ND - Not detected above reporting limit

RL - Laboratory reporting limits

Sample ID (GOLLOB-2013-4) = probe ID (GOLLOB-2013-4). The depth of the probe is NOT included in the sample ID.

APPENDIX F
ATTACHMENTS

Attachment F1	Soil Gas Probe Installation Forms – Temporary Probes in Gollob Park
Attachment F2	Soil Vapor Sampling Forms – Temporary Probes in Gollob Park
Attachment F3	Photographs – Installation and Sampling of Temporary Probes in Gollob Park

ATTACHMENT F1
SOIL GAS PROBE INSTALLATION FORMS
TEMPORARY PROBES IN GOLLOB PARK

Soil Gas Implant ID Gollob-2013-1

Logged By

M. Busby

Drilling Contractor

Geo Mechanics

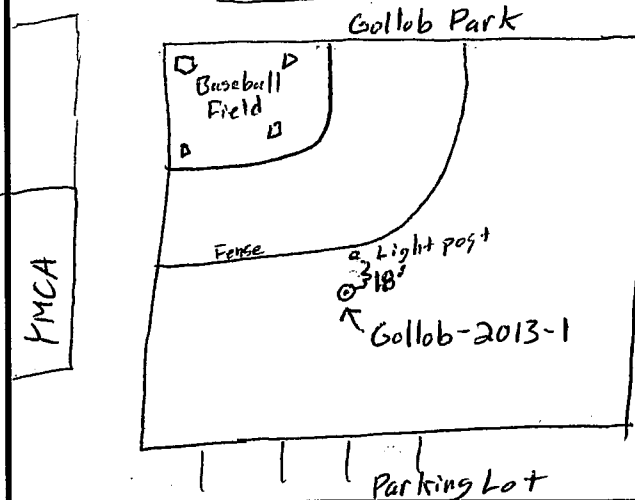
Northing 35641206.26

Easting 516005.73

Date/Time Installed 2/20/13

Implant Location Map

Not to Scale



Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

Implant Purge Volume

Tubing Diameter (in)	<u>0.25 3/16"</u>
Length of Tubing (ft)	<u>18'</u>
Borehole Diameter (in)	<u>0.25 2.375"</u>
Height of Sand (in)	<u>1.3</u>
Purge Volume of Tubing (ml)	<u>179.73</u>
Purge Volume of Sandpack (ml)	<u>1132</u>
Purge Volume of Tubing+Sandpack (ml)	<u>1911.73</u>

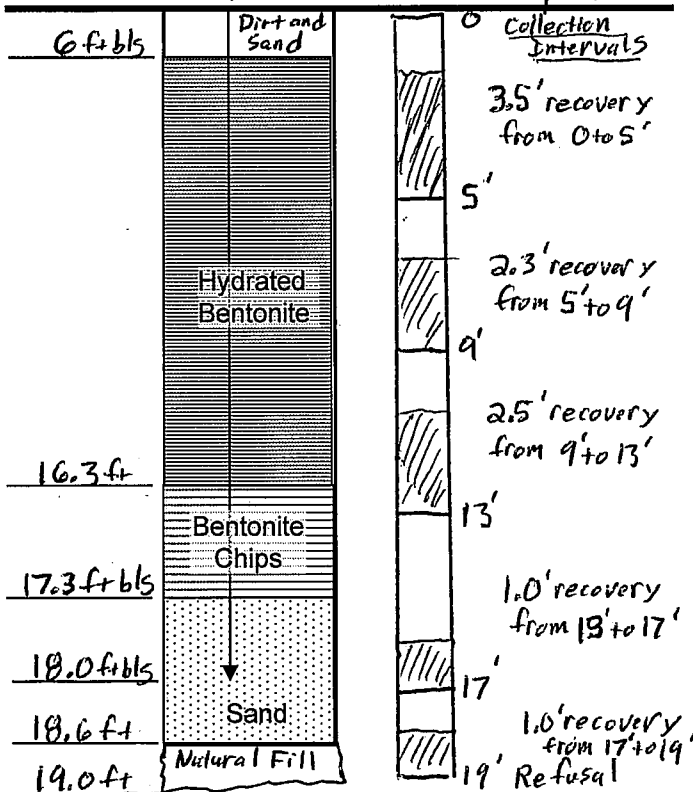
Implant As-Built Diagram

Depth of Materials

Tube ID
1/4"

Land Surface

Geophone



Soil Borehole Log

Unified Soil Classification System

Grass Field

- 0' - Top soil w/ sand
- 1' - Clayey sand with gravel [SM] a horizon 2' w/ organic smell and darker gray color, silt to 1" dia cobbles, subangular to subrnd. 70% sand 20% silt 10% gravel color range from 7.5 YR 7/4 Pink to 7.5 5/3 Brown
- 8.5' - Demolition Debris - chunks of red brick up to 1" dia, black organic smelling clay w/ white and brown pieces of unknown material 2 cm. slight oily smell PID reading 0.0 ppm, 1' section of wet gray clayey sand [SC] Nail found
- 17' - Cobbles 1/2 to > 1 in, quartzite and Limestone 20% sand v. coarse to v. fine 20% gravel. All clast sub-ang to subrounded Dark Greenish Gray
- 19' - Refusal

Soil Gas Implant ID Gollob-2013-2

Northing 3564212.57

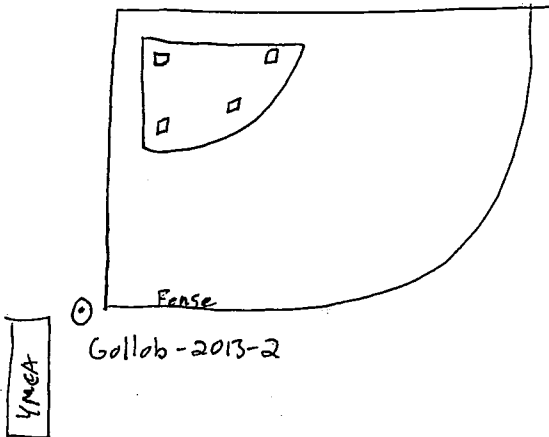
Logged By M. Busby
Drilling Contractor Geo mechanics

Easting 515965.03

Date/Time Installed 2/20/13

Implant Location Map

Not to Scale



Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

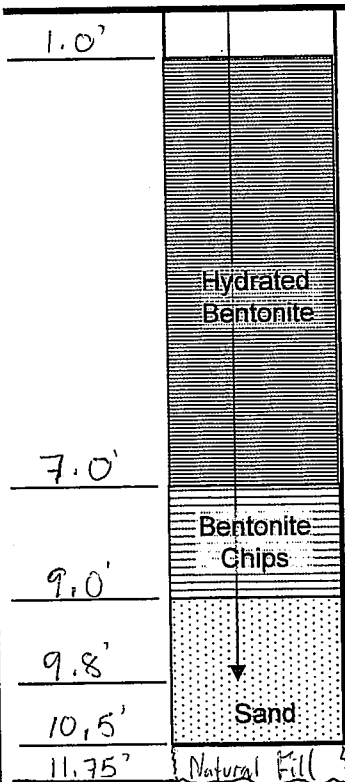
Implant Purge Volume

Tubing Diameter (in)	<u>3/16"</u>
Length of Tubing (ft)	<u>10</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>18</u>
Purge Volume of Tubing (ml)	MS 175.1 <u>94.6</u>
Purge Volume of Sandpack (ml)	<u>1306.7</u>
Purge Volume of Tubing+Sandpack (ml)	<u>1404</u>

Implant As-Built Diagram

Depth of Materials

Land Surface



Soil Borehole Log

Unified Soil Classification System

ft bls 0	Top Soil 5YR 4/4 Reddish brown clayey silt w/ sand (ML) Moist, low plasticity
0.5	Well Graded Sand w/ Gravel (SW) 5YR 6/6 Reddish Yellow, sub angular to sub rounded, 80% sand, 20% Gravel to 3cm
3.0	Black horizon 20.5 ft thick cemented, light organic smell
3.5	Increase in Clay Content 70% sand, 20% Gravel, 10% clay 5YR 5/4 Reddish Brown
5.0	Sand w/ Gravel (SW) 5YR 5/6 Reddish Yellow
9	Cobbles 1/2 to 2 in, quartzite and lime stone
10.75	Refusal
11.75	Refusal

Soil Gas Implant ID Gollob-2013-3

Logged By

M. Busby

Drilling Contractor

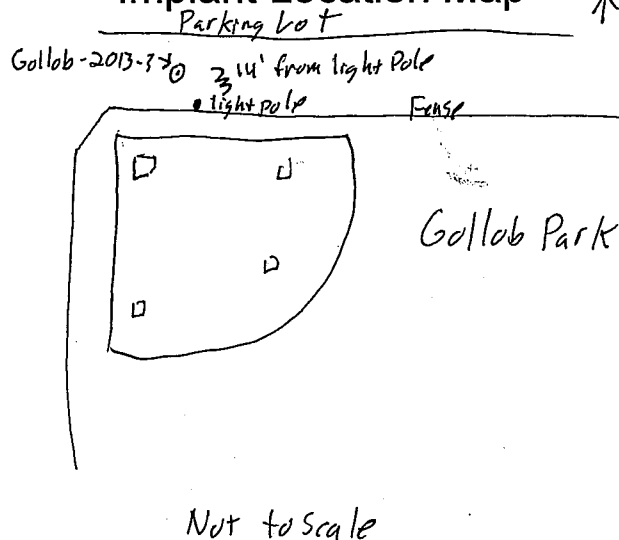
Geo Mechanics

Northing 3564301.75

Easting 515974.92

Date/Time Installed 2/21/13 8:30

Implant Location Map



Purge Volume Calculation

$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

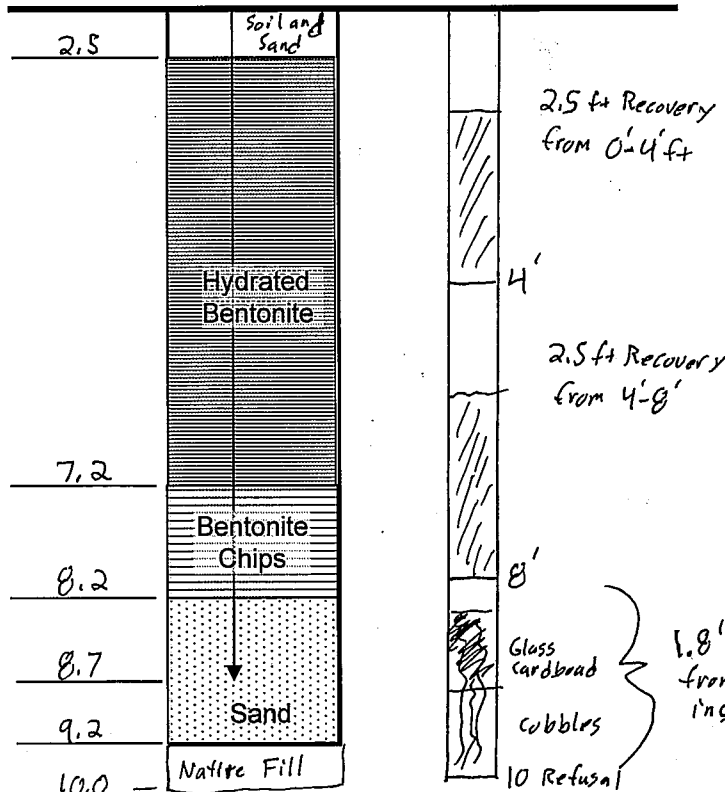
Implant Purge Volume

Tubing Diameter (in)	<u>4 3/8 3/16"</u>
Length of Tubing (ft)	<u>8.7</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>12</u>
Purge Volume of Tubing (ml)	<u>103</u>
Purge Volume of Sandpack (ml)	<u>871</u>
Purge Volume of Tubing+Sandpack (ml)	<u>974</u>

Implant As-Built Diagram

Depth of Materials

Land Surface



Soil Borehole Log

Unified Soil Classification System

ft bls	0	Top Soil 5YR 4/4 Reddish brown clayey silt w/ sand (ml) moist, low plasticity
ft bls	0.5	Gravelly Sand (SW) 5YR 5/3 Reddish brown, Angular to subrounded 70% sand 30% gravel, loose, v. little moisture, piece of wood @ 1 ft bls
ft bls	8	Gravelly sand w/ trash, glass, plastic, cardboard, 40% trash 40% sand 20% gravel 7.5YR 3/4 dark brown, Mild organic odor
ft bls	9	Gravel w/ sand (GW) fine to med 60% gravel 40% sand quartzite and limestone
ft bls	10	Refusal

Soil Gas Implant ID Gollob-2013-4

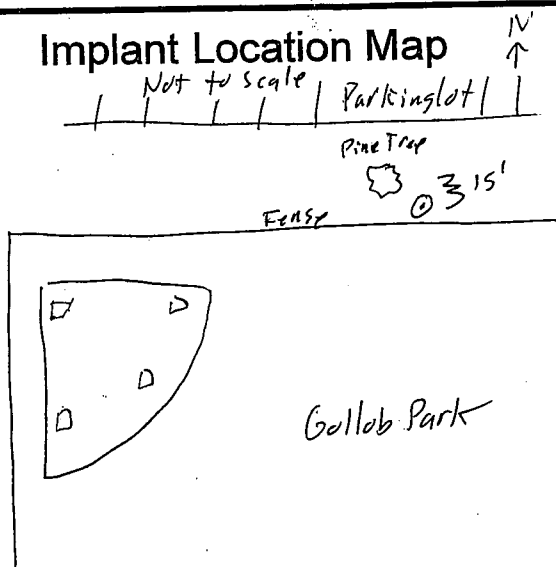
Logged By M. Busby
Drilling Contractor Geo Mechanics

Northing 3564298.81

Easting 516045.81

Date/Time Installed 2/25/13 10:30

Implant Location Map



Purge Volume Calculation

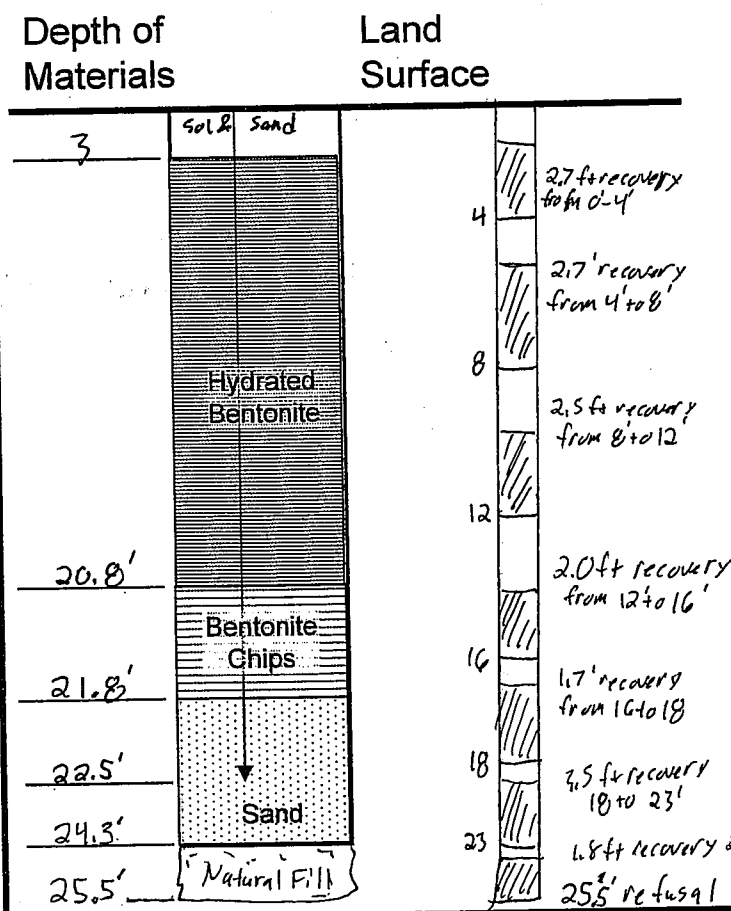
$$\text{Volume Tubing} = ((D_{\text{tube}}/2)^2 * 3.14 * (L_{\text{tube}} * 12)) * 16.3866$$

$$\text{Volume of Sandpack} = (D_{\text{bore}}/2)^2 * 3.14 * H_{\text{sandpack}} * 0.3 * 16.3866$$

Implant Purge Volume

Tubing Diameter (in)	<u>3/4"</u>
Length of Tubing (ft)	<u>22.5</u>
Borehole Diameter (in)	<u>2 3/8</u>
Height of Sand (in)	<u>2.5</u>
Purge Volume of Tubing (ml)	<u>236</u>
Purge Volume of Sandpack (ml)	<u>2178</u>
Purge Volume of Tubing+Sandpack (ml)	<u>2414</u>

Implant As-Built Diagram



Soil Borehole Log

Unified Soil Classification System

ft b/s

- 0 Top Soil 5YR 4/4 Reddish Brown, Moist Clayey silt w/ sand (ML) low plasticity
- 0.8 Gravelly Sand (SW) 5YR 5/3 Reddish brown, Angular to subrounded, low c. v. little moisture, fine to 2cm, 70% sand 30% gravel, thin 1/2" clay lenses
- 9 Sandy Gravel Sand w/ cobbles - (GM) Gley 2 7/1 light bluish gray, Fine rock powder to > 1" 70% gravel, 20% sand 10% fines, dry
- 11.7 Trash, Newspaper, glass, plastic bags, rubber, oily sand (Si2ppm w/ PID) Color Ranges from white to gray to brown to black, wood, oily odor 50% trash, 40% poorly graded sand, 10% fine gravel. Red brick and wood pieces
- 20 Sand w/ Gravel and Silt (SM) 7YR 4/3 Brown, fine to 2cm, ang to subrounded, dry, a couple
- 25.5 Refusal Pieces of glass, mild oil odor

ATTACHMENT F2
SOIL VAPOR SAMPLING FORMS
TEMPORARY PROBES IN GOLLOB PARK

Soil Vapor Sampling Form - Summa Canisters

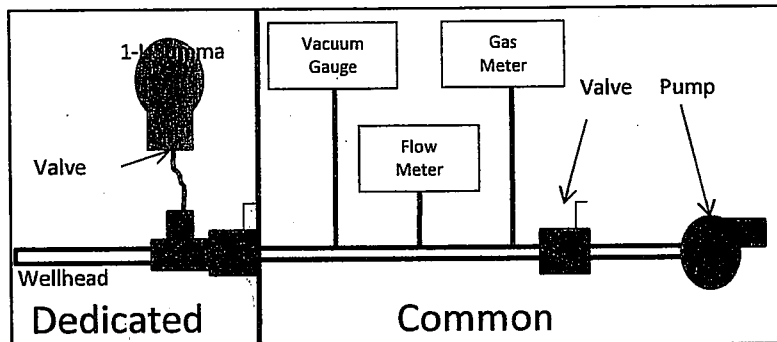
Well ID (depth): Gallobo-2013-1 SE (184+)
 Site Location: Gallobo Park
 Condition of Well: Good

Date: 2/22/13
 Samplers: MB, VNH
 QA Sample ID: NA

Purge Volume Calculation

Purge Volume (from SAP tables): 3972 mL

Volume Purged Prior to Sample Collection: 4000



Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1353	0	200	0	0			
1358	5	200	1000	0	0.8	2.8	18.2
1403	10	200	2000	0	0.9	3.2	17.7
1408	15	200	3000	0	0.8	3.1	17.6
1413	20	200	4000	0	0.8	3.0	17.7

Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:

A6611

Summa Canister Lab Number:

743

Flow Regulator and Vacuum Gauge Serial Number:

NA

Vacuum Pump Start Time

1353

Vacuum Pump Stop Time

1414

Open Summa Time

1414

Close Summa Time

1420

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

Post-Fill Summa Canister Vacuum (in. Hg):

-1

Time Sample Collected

1414

Notes:

1.25 in Probe Dia

$$(0.005454)(\text{Dia})^2(L)(2836.9) = \text{Vol}$$

18 ft Probe L

$$\text{Vol}_{\text{probe}} + \text{Vol}_{\text{dead}} + \text{Vol}_{\text{bore}} = \text{Vol}_{\text{Total}}$$

1.25 in Dead Dia

$$\text{Vol}_{\text{Total}} \times 3 = \text{Purge Vol}$$

2 ft Dead L

2.375 in Bore Dia

1.3 ft Bore L

[Signature]

2/22/13

Soil Vapor Sampling Form - Summa Canisters

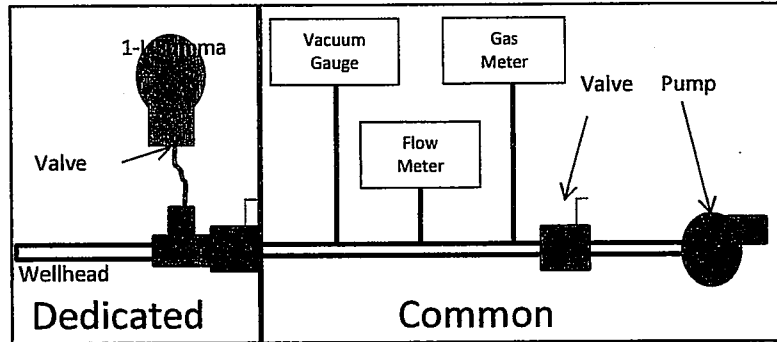
Well ID (depth): Gollob - 2013-2 SW (10 ft)
 Site Location: Gollob - Park
 Condition of Well: Good

Date: 2/22/13
 Samplers: VH, MB
 QA Sample ID: NA

Purge Volume Calculation

Purge Volume (from SAP tables): 41140 mL

Volume Purged Prior to Sample Collection: 4000 mL



Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
1312	0	200	0	0	/	/	/
1317	5	200	1000	0	0.3	0.3	22.4
1322	10	200	2000	0	0.4	0.2	22.4
1329	15	200	3000	0	0.4	0.3	22.1
1332	20	200	4000	0	0.4	0.3	22.2

Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number: 6487
 Summa Canister Lab Number: 579
 Flow Regulator and Vacuum Gauge Serial Number: 1007002275
 Vacuum Pump Start Time: 1312
 Vacuum Pump Stop Time: 1332
 Open Summa Time: 1332
 Close Summa Time: 1338
 Pre-Fill Summa Canister Vacuum (in. Hg): -26
 Post-Fill Summa Canister Vacuum (in. Hg): -1
 Time Sample Collected: 1332

Notes: .1875 in = Probe Dia
10 ft = Probe L
.25 in = Dead Dia
2 ft = Dead L
2.375 in = Borehole Dia
1.5 ft = Borehole L

$(.005454)(\text{Dia})^2(L)(28316.9) = \text{Vol}$
 $\text{Vol}_{\text{probe}} + \text{Vol}_{\text{dead}} + \text{Vol}_{\text{bore}} = \text{Vol Total}$
 $\text{Vol Total} \times 3 = \text{Vol purge}$

Summa 2/22/13

Soil Vapor Sampling Form - Summa Canisters

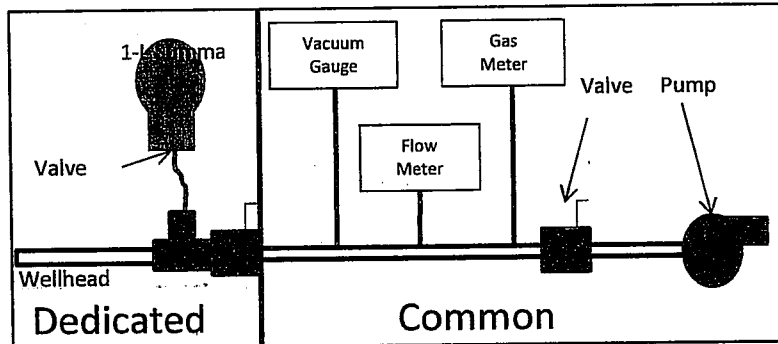
Well ID (depth): Grollob-2013-3 (NW) (8.74)
 Site Location: Grollob Park (N)
 Condition of Well: New

Date: 2/22/13
 Samplers: VNA
 QA Sample ID: NA

Purge Volume Calculation

Purge Volume (from SAP tables): 2733 mL

Volume Purged Prior to Sample Collection: 3000



Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (cc/min)	Volume Purged (cc)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0937	0	200	0	0	/	/	/
0940	3	200	600	0	0.0	2.2	19.1
0943	6	200	1200	0	0.0	2.2	19.1
0946	9	200	1800	0	0.0	2.2	19.1
0949	12	200	2400	0	0.0	2.2	19.1
0952	15	200	3000	0	0.0	2.3	19.0

Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:

A8550

Summa Canister Lab Number:

1222

Flow Regulator and Vacuum Gauge Serial Number:

8

Vacuum Pump Start Time

0937

Vacuum Pump Stop Time

0953

Open Summa Time

0954

Close Summa Time

1000

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

Post-Fill Summa Canister Vacuum (in. Hg):

-1

Time Sample Collected

0954

Notes: $0.125 \text{ in} = \text{Probe Dia}$ $(.005454)(.125 \text{ in})^2(8.74)(28316.9 \frac{\text{mL}}{\text{ft}^3}) = 0.21 \text{ mL Probe Vol} > 40 \text{ mL}$
 $8.7 \text{ ft} = \text{Probe L}$ $(.005454)(.25 \text{ in})^2(2 \text{ ft})(28316.9 \frac{\text{mL}}{\text{ft}^3}) \Rightarrow 19 \text{ mL Dead Vol}$
 $.25 \text{ in} = \text{Dead Dia}$ $(.005454)((.25 \text{ in})^2)(1 \text{ ft})(28316.9 \frac{\text{mL}}{\text{ft}^3}) \Rightarrow 871 \text{ mL Borehole Vol}$
 $2 \text{ ft} = \text{Dead L}$ $2(871 \text{ mL} + 40 \text{ mL}) = 911 \text{ mL Total volume}$
 $2.375 \text{ in} = \text{Borehole Dia}$ $911 \text{ mL} \times 3 \Rightarrow 2733 \text{ mL Purge Volume}$
 $1 \text{ ft} = \text{Borehole L}$

[Signature] 2/22/13

Soil Vapor Sampling Form - Summa Canisters

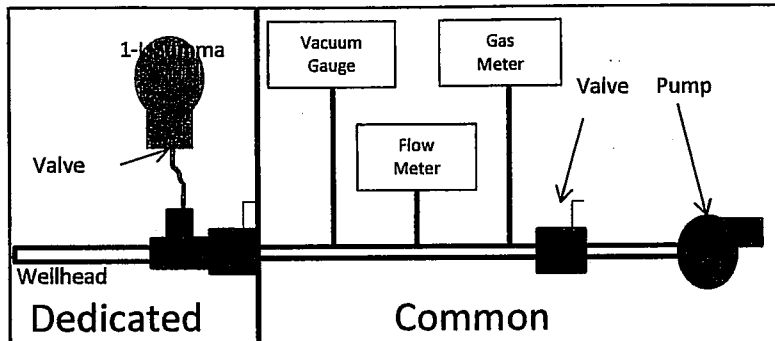
Well ID (depth): Gollob-2013-4 (NE) (22.5ft)
 Site Location: NE corner of Gollob Park
 Condition of Well: Good

Date: 2/26/13
 Samplers: MB + VNH
 QA Sample ID: NA

Purge Volume Calculation

Purge Volume (from SAP tables): 6957 mL

Volume Purged Prior to Sample Collection: 7000 mL



Well Evacuation

Time	Elapsed Time (minutes)	Purge Rate (mL/min)	Volume Purged (mL)	Vacuum (in. water)	Landfill Gas Concentrations		
					CH4	CO2	O2
0946	0	250 mL	0	0			
0953	7	250 mL	1750	0	0.6	5.5	15.6
1000	14	250 mL	3500	0	0.6	5.3	15.6
1007	21	250 mL	5250	0	0.7	5.3	15.5
1014	28	250 mL	7000	0	0.8	6.5	14.5

Sample Collection

QC Sample Collected: Yes ☐ No ☒

Summa Canister Serial Number:

A8223

Summa Canister Lab Number:

1078

Flow Regulator and Vacuum Gauge Serial Number:

4

Vacuum Pump Start Time

0946

Vacuum Pump Stop Time

1014

Open Summa Time

1015

Close Summa Time

1021

Pre-Fill Summa Canister Vacuum (in. Hg):

-27

Post-Fill Summa Canister Vacuum (in. Hg):

-1

Time Sample Collected

1015

Notes: Probe $\frac{3}{16}$ " Dia X 22.5 ft L $\rightarrow (0.005454)(\text{Dia (in)})^2 (L(ft)) (28316.9 \frac{\text{mL}}{\text{ft}^3}) = \text{Vol}$
 Dead Space $\frac{1}{4}$ " Dia X 2 ft L $\text{Vol}_{\text{probe}} = \text{Vol}_{\text{dead}} + \text{Vol}_{\text{bore}} = \text{Vol}_{\text{Total}}$
 Borehole $2\frac{3}{8}$ " Dia X 2.5 ft L $\text{Vol}_{\text{Total}} \times 3 = \text{Purge Volume}$

Sampler's Signature

[Signature]

Date 2/26/13

**CLEAR
CREEK
ASSOCIATES**

ATTACHMENT F3
PHOTOGRAPHS
INSTALLATION AND SAMPLING OF TEMPORARY PROBES IN GOLLOB PARK

Attachment F3 - Photographs Installation and Sampling of Temporary Probes in Gollob Park

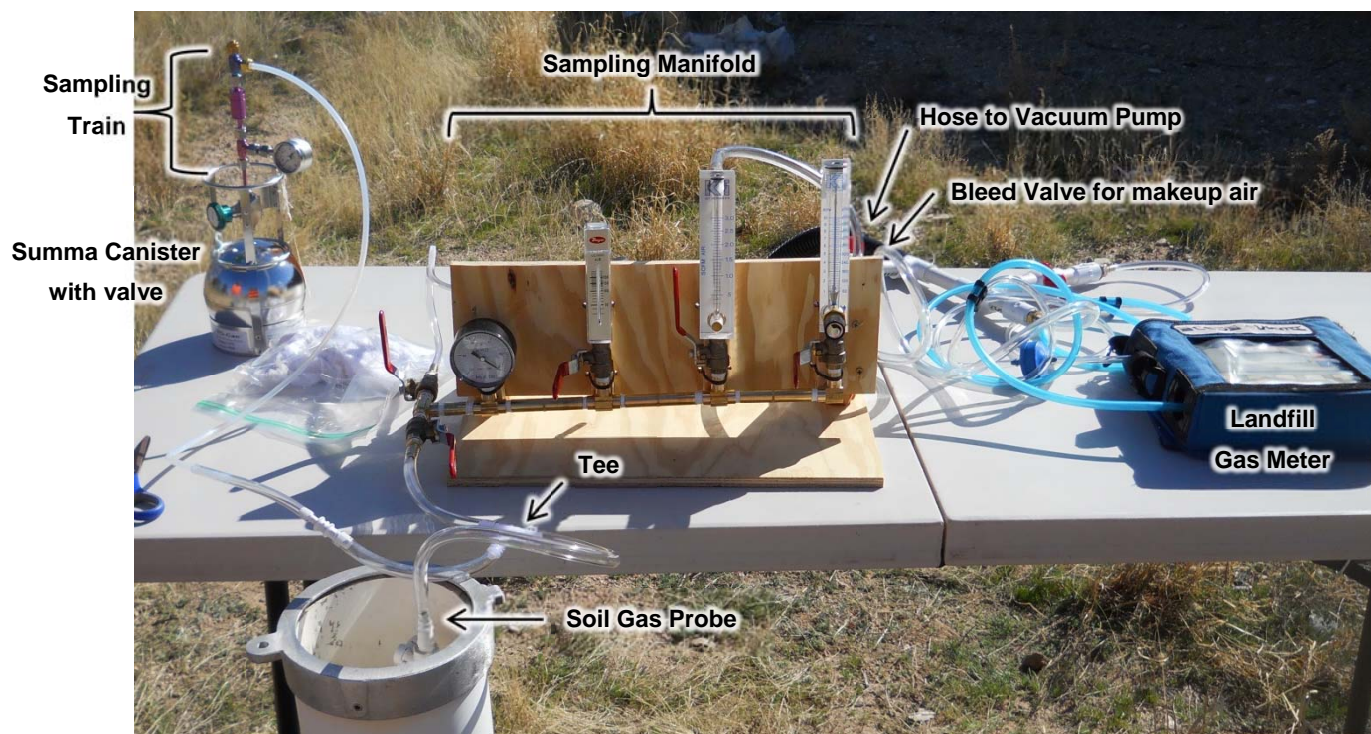
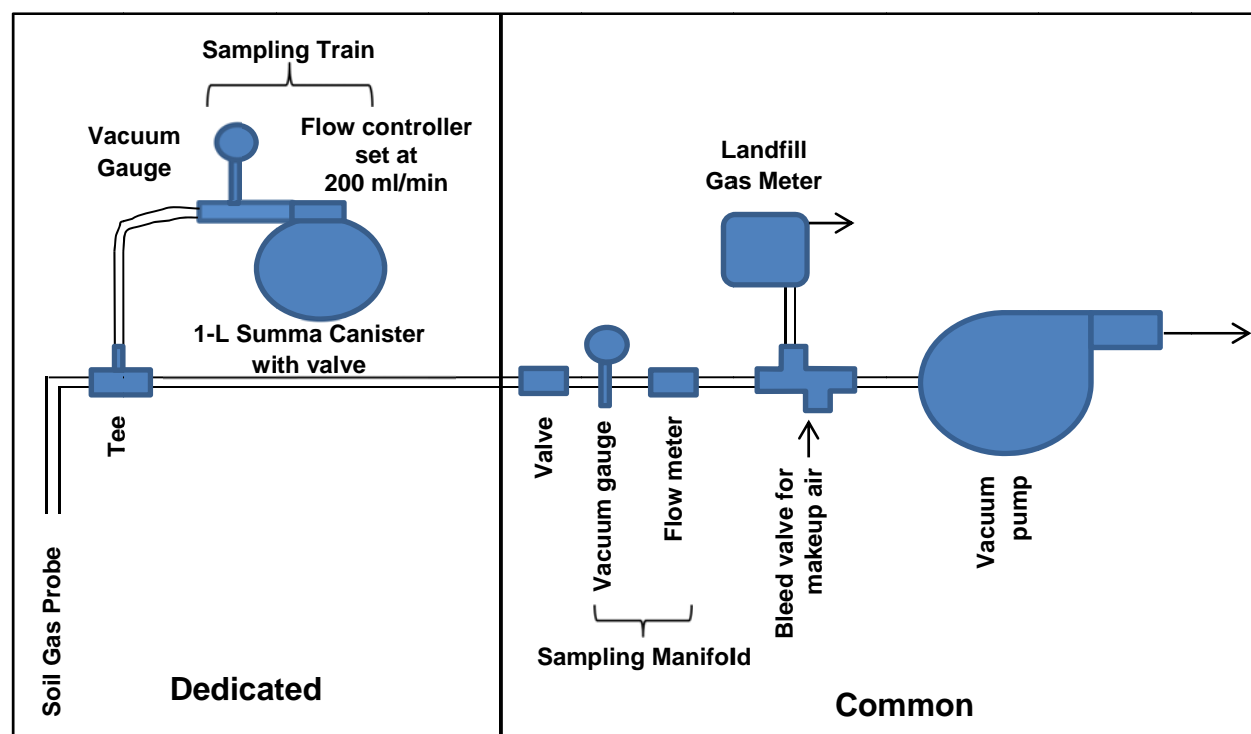


Photo of Soil Gas Sampling System



Schematic Drawing of Soil Gas Sampling System

Attachment F3 - Photographs Installation and Sampling of Temporary Probes in Gollob Park



Installing temporary soil gas probes in Gollob Park, Gollob-2013-2 (Feb 20, 2013)



Gollob-2013-4 (Feb 21, 2013)



Gollob-2013-1 (Feb 20, 2013)

Attachment F3 - Photographs Installation and Sampling of Temporary Probes in Gollob Park



Acrylic liners with material removed during probe installation, Gollob-2013-4 (Feb 21, 2013)



Old newspaper removed during probe installation, Gollob-2013-4 (Feb 21, 2013)



Gollob-2013-1 (Feb 20, 2013)



Gollob-2013-2 (Feb 22, 2013)

Attachment F3 - Photographs Installation and Sampling of Temporary Probes in Gollob Park



Clark Gable was 59 in 1960. He died before the end of the year.