STANDARD OPERATING PROCEDURE NO. 9

TEST PIT EXCAVATION, LOGGING, AND SAMPLING (SOLID)

REVISION LOG		
Revision Number	Description	Date
9.0	Original SOP	
9.1	Revisions by PJP	5/20/2004
9.2	Revisions by PJP	6/3/2004
9.3	Revisions by JCC	6/10/04
9.4	Revisions by GWW, VTM	6/16/04
9.5	Revisions by VTM	6/21/04
9.6	Revisions by PJP	6/22/04
9.7	Revisions by PJP, BEB, PXW, VTM, GWW	9/13/2004
9.8	Compilation of revisions by PJP	9/22/2004
9.9	Revisions by KMD, GWW, JRM	9/25/2004
9.10	Revisions by PJP as per comments by Erich Rauber and George Robinson	9/27/2004
9v11	Revised to include new SOP, approved VTM	01/17/2005
9v11	Finalized by LMK for posting to Molycorp website and to send George Robinson for lab audit	3/20/07
9v12	Editorial by SKA	10/22/08

1.0 PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides technical guidance and methods that will be used to log and sample test pits, trenches, and longwall cuts during environmental investigations in connection with the Questa Rock Pile Stability Study at the Molycorp mine. This SOP is a supplement to the site-wide and investigation area specific workplans and field sampling plans (FSPs), and should be used in conjunction with the other SOPs in this volume.

2.0 RESPONSIBILITIES AND QUALIFICATIONS

The Characterization Team Leader has the overall responsibility to implement this SOP. He/she will be responsible for assigning appropriate environmental staff to implement this SOP and for ensuring that the procedures are followed accurately.

All personnel performing these procedures are required to be familiar with environmental data, its generation, and its reporting. In addition, all personnel are required to have a complete understanding of the procedures described within the Quality Assurance Project Plan (QAPP) and this SOP. Activity-specific training regarding these procedures will be provided by the Field Manager (FM) or designated QA/QC Manager to personnel implementing this SOP, as necessary.

All staff are responsible for reporting deviations from this SOP to the Characterization Team Leader.

Personnel overseeing test pit/trench excavation and backfilling, and who perform logging and sampling activities will be geotechnical engineers, trained geologists, and/or other trained personnel that have applicable field experience in overseeing test pit/trench work. Personnel overseeing test pit/trench activities must be familiar with health and safety requirements in the project-specific Health and Safety Plan (HASP) and local, state, and federal regulations governing excavations.

Molycorp, Inc. or their contractors will conduct the excavation and backfilling of test pits and trenches. Molycorp, Inc. or their contractors will be responsible for handling and disposal of any derived waste material (oil spills, resins and other generated wastes).

3.0 RELATED STANDARD OPERATING PROCEDURES

The procedures for test pit excavation and sampling set forth in this SOP are intended for use with the following SOPs:

- SOP 1 Data Management
- SOP 2 Sample Management
- SOP 3 Surveying (GPS)
- SOP 4 Taking Photographs
- SOP 5 Sampling Outcrops, Rock Piles and Drill Core
- SOP 6 Drilling, logging, and sampling of subsurface materials (solid)

- SOP 7 Decontamination of Sampling Equipment
- SOP 14 Field Filtration of Water Samples
- SOP 16 Ground-Water Sampling
- SOP 33 Particle Size Analysis
- SOP 34 Sampling for the Remaining Pyrite Model
- SOP 35 Volumetric moisture content
- SOP 40 Gravimetric Water Content
- SOP 41 Reflectance spectroscopy
- SOP 42 Porosity
- SOP 43 Tensiometers and Thermo-Conductivity Sensors
- SOP 49 Chip tray preparation
- SOP 53 Tension Infiltrometer Measurements of Hydraulic Conductivity
- SOP 55 General Microbial Sampling - Solids
- SOP 56 Classical Microbial Analysis - Solids
- SOP 57 Microbial Laboratory Safety
- SOP 58 Microbial Metabolic Profiles - Biology
- SOP 59 Microbial Nucleic Acid Analysis
- SOP 60 Slurry Ph – Redox – Conductivity - Temperature
- SOP 61 Nuclear Density Gauge
- SOP 63 Kelway
- SOP 64 Portable-Tensiometers
- SOP 65 Sand-Cone
- SOP 66 Gas-Analyzer
- SOP 70 Sand-Replacement
- SOP 71 Guelph Permeameter
- FSP Field Sampling Plan
- GMP Geologic Mapping Plan

4.0 EQUIPMENT LIST

The following materials and equipment may be needed for the excavation and sampling of test pits/trenches:

- Appropriate bound sample and log forms from the database, including chain of custody forms (Appendix)

- Indelible black-ink pens
- Digital Camera
- Tape measure
- Backhoe or other excavation equipment
- Stainless steel shovels, picks, chisel, rock hammer, and/or scoops
- Sample bags with tags to labels collection interval
- Teflon bailer and nylon cord
- Protective clothing and equipment, as required
- Appropriate field monitoring instruments (see Table 1)
- Decontamination supplies and equipment, as required (e.g., high pressure sprayer/washer, wash/rinse tubs, brushes, liquinox, plastic sheeting, paper towels, sponges, baby wipes, garden-type water sprayers, large plastic bags, potable water, distilled or deionized water)
- Sample containers, coolers, ice (or ice substitute), chain-of-custody (COC) forms, as specified in the Field Sampling Plan (FSP) and appropriate SOPs
- Stainless steel trowels, scoops, bowls, and knives
- Stainless steel slide hammer drive sampler with extension rods, stainless steel tubes, Teflon® sheeting, and plastic caps

5.0 PROCEDURES

Unless otherwise specified in the FSP, a test pit (hand-dug) or trench (machine-dug) will consist of an excavation dug through soil, mine soil, rock pile, and/or buried material.

Important: Personnel will not enter a test pit/trench until authorized by the Safety Officer. Substantial local, state, and federal regulations and site-specific health and safety requirements apply for entry into excavations over four feet deep. The project health and safety officer must be notified prior to any activity involving entry of personnel into excavations.

Test pits may be square or rectangular in shape and any size. Trenches are normally excavated with benches not exceeding 4 feet in height to give an overall slope of 1.4 Horizontal to 1.0 Vertical as shown in Figure 1. The trench may extend for any length needed to explore site conditions. Larger and deeper excavations may be required for project specific objectives, or where field conditions warrant. The geotechnical engineer or field geologist will determine the exact depth and construction of the pit(s) or trench(es) during excavation. Construction of the trenches will be stepped or sloped or stabilized by a trench box, in accordance with OSHA regulated practices. See Table 1 for trenching and sampling flow chart.

Each test pit/trench is assigned a unique test pit/trench number. Sequential bench numbers are assigned, starting with Trench LFG-005.

PREPARATION

The following activities will be performed in preparation for test pit/trench excavation and sampling:

- Prior to any intrusive drilling, clear the excavation area for buried utilities in accordance with Molycorp, Inc Utility Clearance.

TRENCH EXCAVATION

Trenches will be dug using excavation equipment unless otherwise specified by Molycorp. Procedures for excavating the test pit/trench are:

- Carefully excavate thin layers of soil (no more than two feet thick with each scoop of the backhoe) and deposit in the appropriate container.
- Watch carefully for buried materials, especially materials that may pose a safety hazard. If buried containers potentially containing liquids (e.g., drums, carboys, or tanks) are encountered, **cease excavation** and notify the health and safety officer.
- Obtain field instrument measurements as required by the FSP or HASP plan during excavation. Record all information in the field logbook.
- If pit/trench walls cave in, lay back walls sufficiently to prevent caving.
- Obtain field instrument measurements (Table 1) as required by the FSP or HASP plan following excavation. Record all information in the field logbook.
- Following excavation, sketch both walls of the test pit or trench, log the lithology of the test pit/trench walls and collect soil, buried material, and/or water samples, as specified in the FSP, Geologic Mapping Plan, and in Table 1.
- Photograph all significant features exposed by the test pit/trench. Record all pertinent photograph information on the test pit/trench log Table 1.

IN SITU OBSERVATIONS, MEASUREMENTS AND COLLECTION OF SOIL, BURIED MATERIAL, AND WATER SAMPLES

Observations – Sketch, Photo, Log, In Situ Measurements, Testing and Sampling

The following in situ measurements will be carried out along the horizontal and vertical surfaces of each exposed bench and along the base of the trench: sand cone – density (SOP needed), tensiometer/suction, moisture content, grain size (bucket) (SOP 5), matric suction (SOP 43), infiltration tests (SOP 51), and nuclear gauge testing (SOP 61). Samples will be collected for the measurement of gravimetric water content (SOP 40) at the same locations selected for the measurement of matric suction. Samples will also be obtained at the same time for biological analysis (SOP 55). The sequence for in situ measurements, testing and sampling for a typical bench is illustrated in Figure 2. The exact location and frequency of the measurements, tests and samples obtained along the exposed surfaces will be determined on the basis of field inspection and conditions observed within the excavation. Table 1 summarizes the procedures.

Subsurface Soil and Buried Material Samples

The FSP may require sampling of subsurface soil and/or buried materials for chemical analysis. Unless otherwise specified in the FSP, subsurface soil and buried material samples will be collected by hand from the wall of the pit/trench as directed in Table 1.

Samples of excavated material will either be collected at discrete depths or as composite samples over a vertical interval, as specified in the FSP. In either case, a composite sample of each bucket will be obtained by collecting five incremental samples per bucket. For discrete depth samples, one composite sample will be obtained corresponding to the depth of interest. For vertical composite samples, one composite sample will be obtained from successive discreet samples from the depth interval of interest. Those successive samples will then be combined to form the vertical composite sample.

Procedures for collecting soil samples at discrete depths for chemical analysis will involve procedures from SOP 5.

Water Samples

The FSP may require sampling of seepage (SOP 15) or ground water (SOP 16) that enters a test pit/trench for chemical analysis. The sample containers will be handled in accordance with the FSP, SOP2-Sample Management and SOPs 30 and 31.

Channel Sampling Test Pits and Trenches

Once a near vertical wall has been established in the test pit, channel sampling for pyrite reserve modeling can be done in short 5 foot long vertical slots using a rock hammer to chip material which is then placed into a sample bag. The sampler needs to try to obtain as representative a sample as possible over each 5 foot channel sample interval. The intervals are numbered and labeled to include the depth below surface, eg. 0-5, 5-10, 10-15, etc. so the location is retained. Sampling can be done into a small plastic bucket which is held in one hand as the hammer in the other hand is used to sample and cause

loose material to fall into the bucket by gravity. Alternatively, where the material is consolidated, it may be necessary to use a hammer and chisel. A second person is then required to manage the collection bucket. Contents of each bucket are poured into the sample bag for that interval and labeled. Another method of collection is to use a chisel or rock hammer to scoop material onto a plastic trowel to put into a sample bag. This method does not require the use of a bucket during sample collection.

Rock pile sampling for microprobe analysis

1. Collect samples in Nalgene snap-top vials, either 23mm or 27 mm diameter. Label both side and edge of top for each vial.
2. From each place where a bucket sample is collected, fill one vial with representative, relatively intact fine-grained matrix. You can either press the vial into the outcrop, or remove a piece of matrix and place it in the vial.
3. From each place where a bucket sample is collected, collect a piece of rock of the dominant lithology. Break off a piece that fits in the vial, and be sure to include the outer, weathered edge of the rock.
4. Inspect the unit. If there are distinctive zones within the unit, such as particularly oxidized, reduced, or clay-rich layers, collect matrix samples of those.
5. Inspect the range of rock clasts within the unit. If they are relatively uniform, do not collect more. However, if there appear to be pieces of rock with distinctly different degrees of alteration or weathering, collect samples of those, including a piece of weathered edge as described above.

Sampling for Weathering Cells

Aproximately 20 pounds of material from selected layers (based on observations of those working in the test pits) will be collected for potential weathering cell tests and stored until Phase 2 of the project begins.

Emergency procedures in the event of a wall collapse

1. Stop project
    a. Stop equipment
    b. Head count to see if personnel are buried/missing (if yes – GOTO 2)
    c. Evacuate all personnel from work area
    d. Barricade area
    e. Notify safety for near miss review
    f. Re-evaluate test pit design and procedures before continuing work

2. Emergency procedure activation
    a. Call on mine frequency radio
        ~~i.~~ Identify problem
        ~~ii.~~ Give location
        iii. Number of people impacted
3. Stabilize environment

a. Immediately evacuate unaffected personnel – clear of area
b. Move equipment back 20 feet from trench edge
c. Render first aid as needed without exposure
d. Wait for Emergency Response Team to take over
e. ONLY ENTER PIT FOR RESCUE IF CAPABLE, AND IF NO POSSIBILITY OF FURTHER COLLAPSE IS EVIDENT

BACKFILLING OF TEST PITS/TRENCHES

Test pits/trenches will be backfilled by Molycorp, Inc., under the direction of the field engineer/geologist, using the excavated material. The source of the fill will be determined prior to excavating the test pits/trenches. Test pits/trenches will normally be backfilled the same day as excavation, immediately after completion of sampling and/or logging. If pits/trenches are left open overnight, access to the pit/trench will be restricted using barricades or fencing. Trenches in September-November will be leveled as indicated in the Molycorp Goathill deconstruction plan.

The following steps shall be followed when backfilling test pits/ trenches:

- Backfill with clean fill on the same day as the excavation, or as soon thereafter as practical. Determine the source of the backfill prior to excavating the trenches or test pits.
- Place backfill in the trench or pit bottom in approximately one-foot lifts.
- Compact each lift using the backhoe bucket.
- Decontaminate all equipment in accordance with SOP 7, Decontamination of Sampling Equipment.

6.0 FIELD QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES AND SAMPLES

QA/QC samples are designed to help identify potential sources of sample contamination to evaluate potential error introduced by sample collection and handling. All QA/QC samples are labeled and sent to the laboratory with other samples for analysis. The type and number of QA/QC samples are defined in SOP 2.0 Sample Management.

7.0 SAMPLE HANDLING

Sample containers, preservatives, and analyses are specified in SOP 2, Sample Management. Samples also will be labeled and handled as described in SOP 2.

8.0 DOCUMENTATION (LOGGING)

Documentation of observations and data acquired in the field will provide information on the activities concluded and also provide a permanent record of field activities. The observations and data will be recorded with waterproof ink in a permanently bound

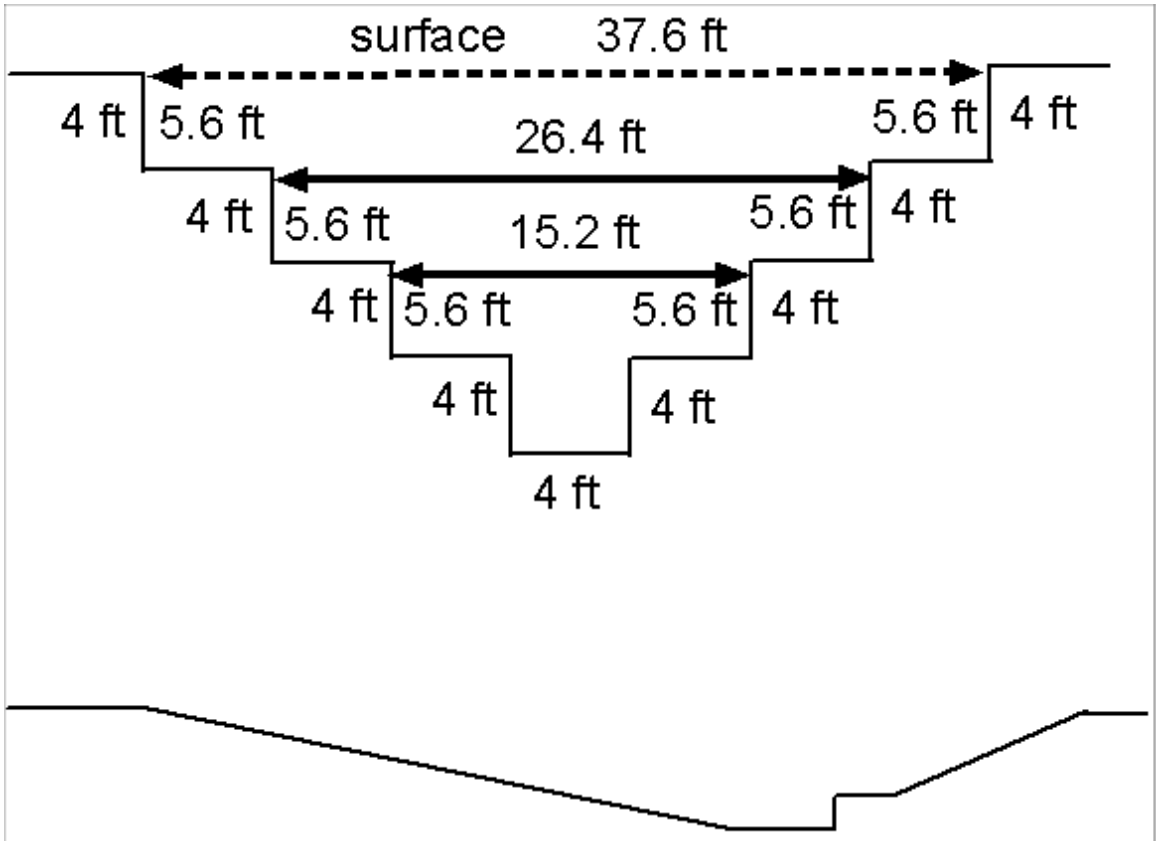
logbook with consecutively numbered pages, and on field data sheets in a bound book (Appendix).

9.0 TEST PIT LOG FORM

The geotechnical engineer or field geologist is responsible for documenting test pit/trench observations and activities. A detailed, complete, and accurate record will be documented on the Test Pit Log form (Appendix) in a bound book to be completed during or immediately following test pit/trench excavation, sampling, and backfilling. If an item on the form is not applicable, the field will be left blank.

10.0 FIELD NOTES

Field notes also will be kept during sampling activities. The information shown in Appendix will be recorded in a bound field book using waterproof ink.



Ramp down making successive smaller width of cut. Each cut should be 4 ft vertical depth. Horrizontal widths of each cut can be wider. Bench width of 5.6 ft was made to slightly less than the angle of 35 degrees.

FIGURE 1. Sketch of test pit for the top of Goathill North rock pile.

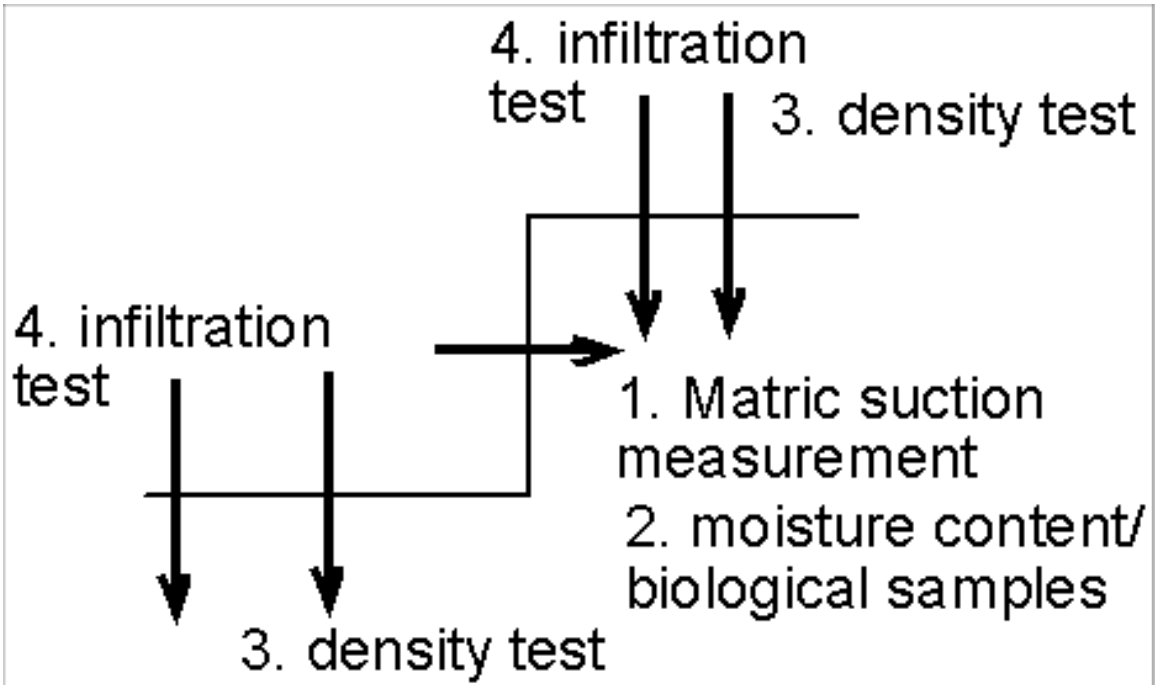


FIGURE 2. Sketch of approximate location of tests and samples for each bench in the test pits.

Table 1

Task list for trench/pit excavation, sampling and instrumentation (followed in June 2004).

1. Decide on location of test pit/trench and draw an outline of the pit on the ground considering safety and location of access roads and other installations
2. Move all personnel and vehicles at least 20m from pit site leaving machine, operator and supervisor
3. Excavator dig test pit/trench to required dimensions (SOP 9)
4. Without disturbing test pit, take photographs of:
    - Test pit/trench walls showing as many benches as possible
    - Individual benches (SOP 4)
5. Decide where to take tensiometer readings (SOP 43) and gravimetric moisture content (SOP 40) and microbiology (JA) samples on the walls of the test pit/trench
6. Take tensiometer readings (SOP 43)
7. Dig back into the test pit/trench wall and take samples for gravimetric moisture content (SOP 40) and microbiology (JA) and flag the sample locations
8. Map walls and benches of the test pit/trench (GM, SOP 9)
9. Decide where to install tension infiltrometers and Guelph permeameters (53), where to take samples for all other laboratory tests and where to take intact samples for porosity, bulk density and volumetric moisture content (SOP 32).
10. Take intact samples for porosity (SOP 42), bulk density (SOP 32) and volumetric moisture content (SOP 35).
11. Measure in situ density with neutron density gauge (SOP 61)
12. Install tension infiltrometers and Guelph permeameters (SOP 53)
13. Take samples for geotechnical tests with splits for chemistry, mineralogy and acid base accounting tests (SOP 5).
14. Take chip tray samples for logging
15. Take photographs of sample locations
16. Backfill the test pit/trench if necessary

Task List for Trench Excavation, Sampling and Instrumentation (followed in September 2004)

These are the steps to be followed in taking samples and making in-situ measurements after each trench has been dug. FOLLOW HASP, FSP, SOP 1 AND 2.

1. A safety perimeter will be established where no one can enter during operation of the equipment. After excavation is completed, move all heavy machinery that is not needed in the trench to a safe location. The perimeter will be secured by berms, signs, tape, cones, or other appropriate means.
2. The team will designate a Safety Officer who will do a preliminary inspection of the trench and will interface with the equipment operator. Preliminary site

inspection notes will be recorded in bound book. Potential hazardous areas will be flagged.

3. Inspect the trench walls and ramps to make sure there are no signs of instability or possible failure. If there are any safety concerns, report them to the supervising engineer or geologist and safety officer for the necessary action to be taken. Berms need to be far from the edge not to affect the stability of the trench. Everyone is responsible for examining the trench at the beginning of each shift and throughout the day.
4. Note the number of people present to work in and around the trench. Everyone must be accounted for at the end of the sampling and measurement exercise. A specific spotter will be designated at times for trench activities who will watch for rock falls, unsafe practices, etc. Only minimum teams of 2 will be allowed in the trench.
5. Immediately following excavation of the trench on Friday afternoon, collect tensiometer readings (SOP 64) and water content samples. Tensiometer readings should be taken along a traverse across the trench with a minimum of one set of measurements per bench per side. A gravimetric moisture content sample (SOP 40) should be collected from at every location that a martic suction or a cluster of matric suction measurements are recorded as described below.
6. Dig back into the test pit wall to the depth that the tensiometers were inserted and take samples for gravimetric moisture content (SOP 40) and microbiology (SOP 55 JA). Sample locations should be flagged and labeled with sample number and the unit designation where appropriate.
7. Survey corners of all benches in the trench and all sample locations along the matric suction and water content traverse (SOP 3).
8. Clean trench walls and prepare for sampling, mapping and logging. Map walls and benches of the test pit (VTM, SOP 9). The mapping scale should be determined by the thickness of the layers, (multiple scales are appropriate).
9. Identify and flag critical or representative layers and/or material types. The locations identified should cover the complete range of material textures, grainsize and degree of oxidation. Select at least one location in each identified location for detailed physical in-situ testing. At each flagged location selected, complete the following set of tests:

    A. Perform one Troxler nuclear densitometer test. Move all personnel out of the trench, leaving only those needed to use the Neutron Density Gauge. Measure in-situ density with Neutron Density Gauge (SOP 61).

    B. Collect three to five tensiometer readings with either the Standard Tensiometers.

    C. Collect one representative gravimetric water content sample. Collect biological samples (SOP 55), paste or slurry pH, ORP and conductivity samples.

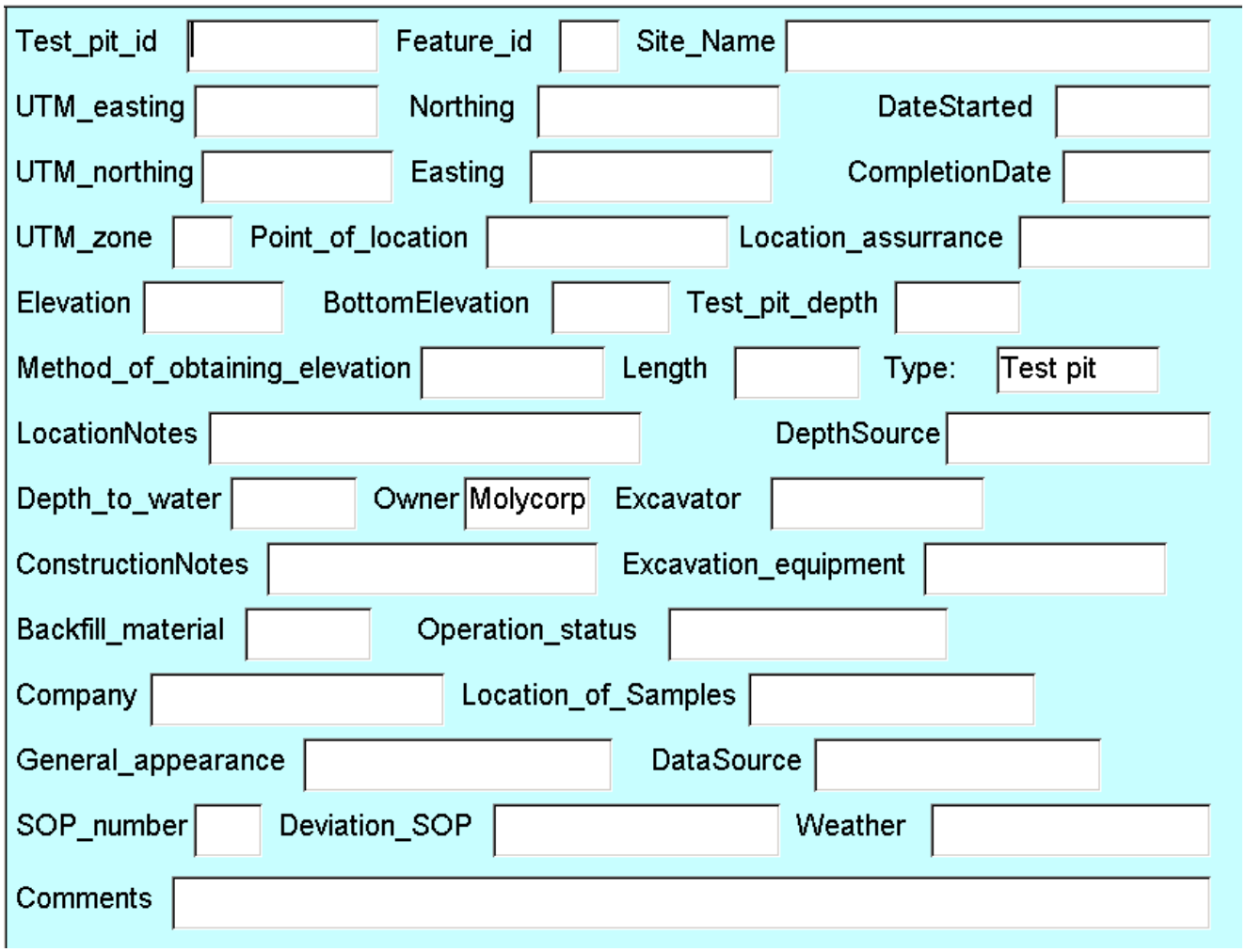
    D. Perform one Guelph Permeameter Ksat test and if applicable one tension infiltrometer test (SOP 53). The location of Guelph Permeameter and tension infiltrometer readings (SOP 53) should be in a stable and less trafficked area of the benches since the instrument and personnel may be there for several hours.

E. Conduct either one water replacement, sand replacement (SOP 90) or sand cone density test (SOP 65).

F. Collect two 20 liter (5gal) pales, one for grainsize analysis and one for direct shear tests and geochemical characterization.

10. Decide where to collect samples for all other laboratory tests and where to take intact samples for porosity (SOP 42), bulk density (SOP 32) and volumetric moisture content (SOP 32).
11. Without disturbing trench, take photographs of trench walls showing as many individual benches as possible (SOP 4).
12. Set up the Thermal Camera and take thermal photographs of the trench walls and floor (SOP 51).
13. Gas analysis along benches (need instrument and SOP 66).
14. Use same set of letters for each trench in field Id, except for pyrite reserve samples, which will have a different set of initials.
15. Sample for pyrite reserve model along a horizontal profile (SOP 34). Take chip tray samples for logging. Take field measurements (soil temperature (SOP 63), redox, paste pH, etc.) Take samples for sulfate minerals for isotopes (SOP 5).
16. If water is present, sample for water (SOP 15)
17. Sample and flag locations. Make sure all sample locations are on map and longitudinal sections. Decide where replicate samples must be taken (SOP 2).
18. Take photographs of sample and instrument locations.
19. Collect undisturbed samples for weathering cells at selected locations (SOP 5).
20. Secure by flag or cone off the trench area and account for all personnel before the team leaves. Time and condition of trench when secured will be recorded in bound book.
21. Backfill trench or level trench as appropriate

APPENDIX.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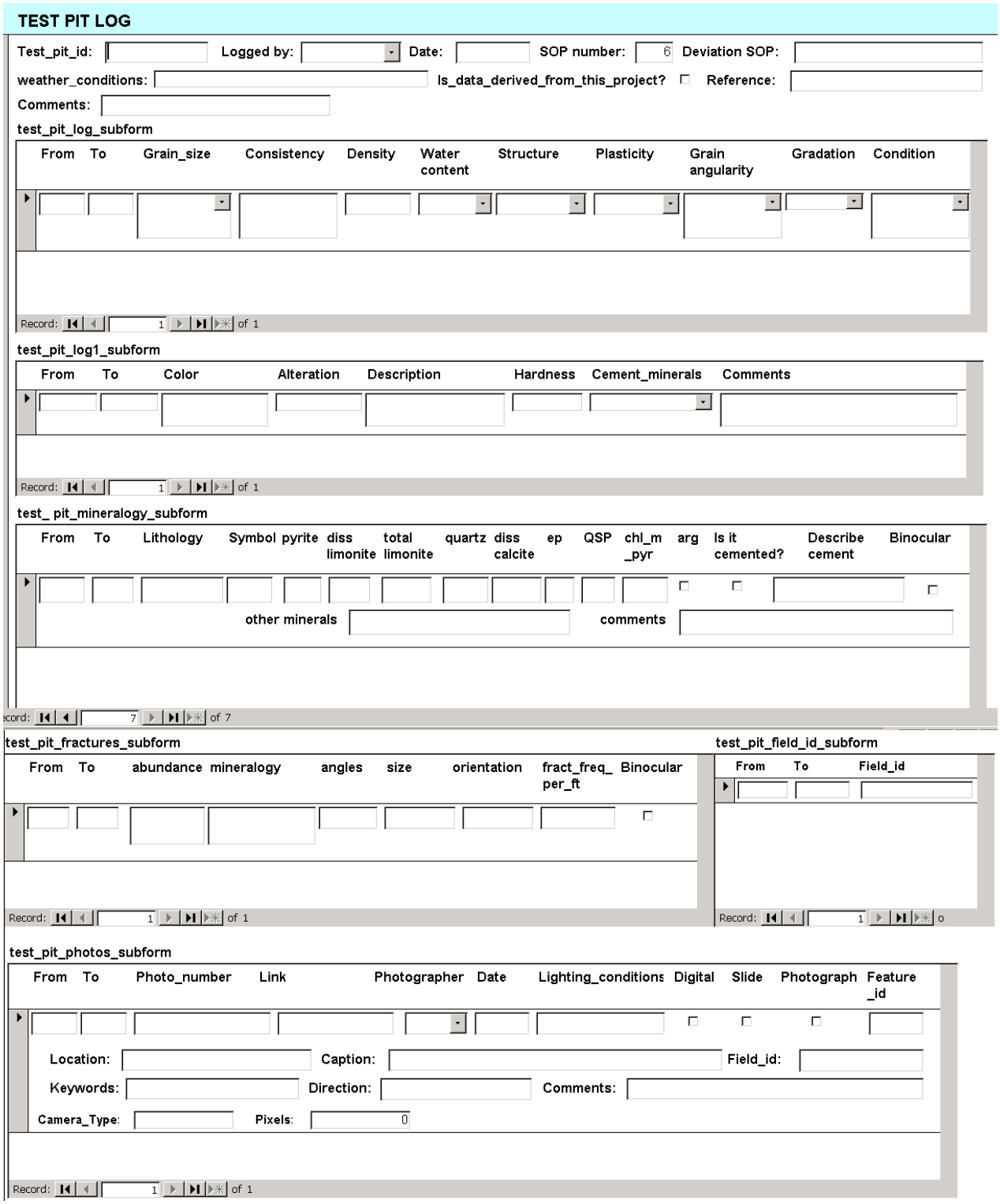
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Location:
Caption:
Field_id:
Keywords:
Direction:
Comments:
Camera_Type:
Pixels: 0
Record: 1 of 1

FIELD SAMPLE FORM

Field_id: Feature_id: Collected by:

Media: Date_collected: weather_conditions:

Elevation: Method_of_obtaining_elevation: Depth_start:

UTM_easting: UTM_northing: UTM_zone: Depth_end:

Location_assurrance: Waypoint: Point_of_location:

Hole_id: Test_pit_id:

SAMPLING

Method_of_sample_collection:

Decontamination:

Type_of_sample: Sample_descrition:

Reason_for_sampling:

Sample_location:

Location_description _of_sample:

Location comments:

SOP_number: Deviation_SOP:

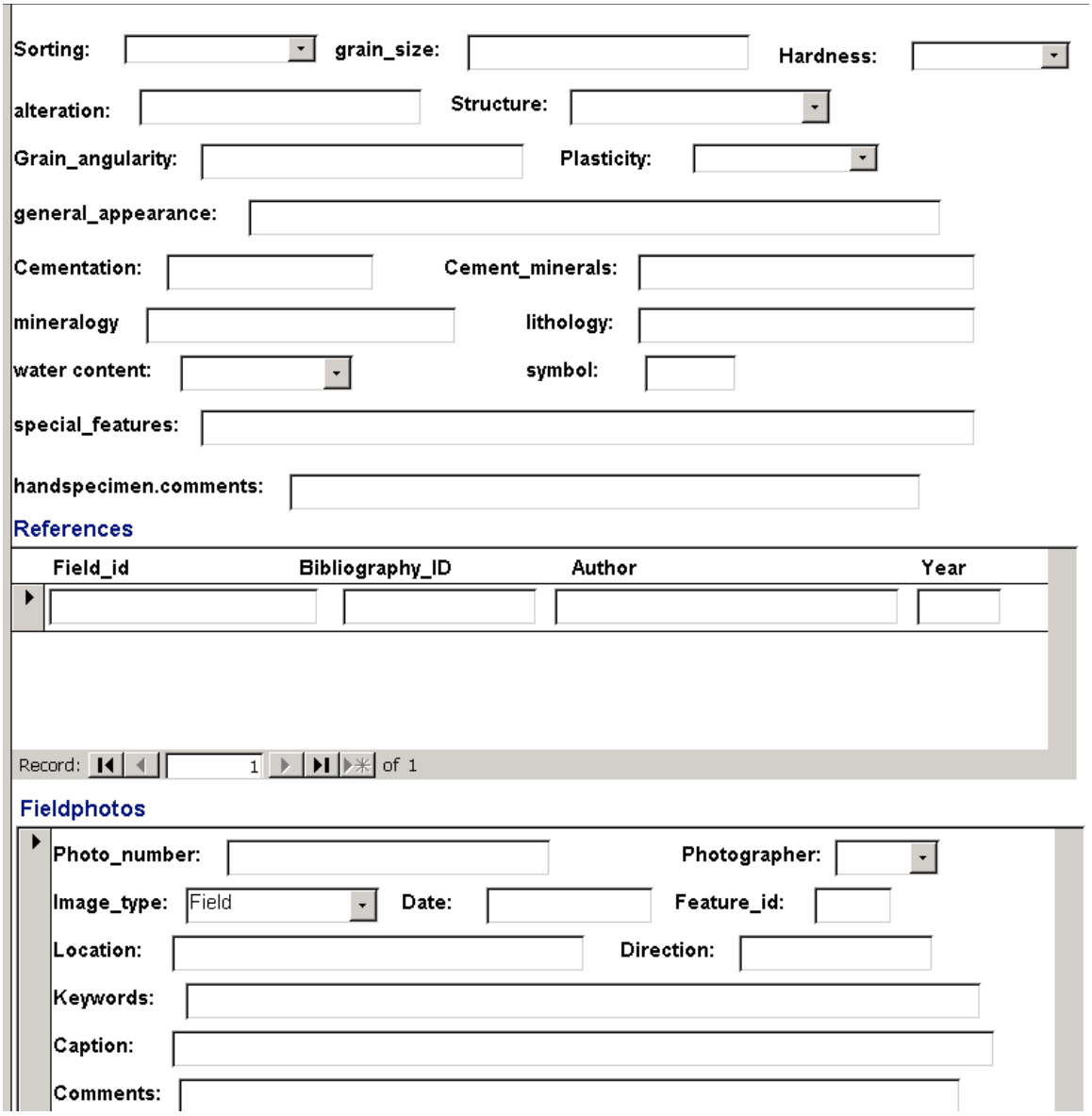
USDA_Texture: USCS_Texture:

HAND SPECIMEN DESCRIPTION

field_description:

color: Color_of_Rind:

Rind_Thickness: Color_of_Core: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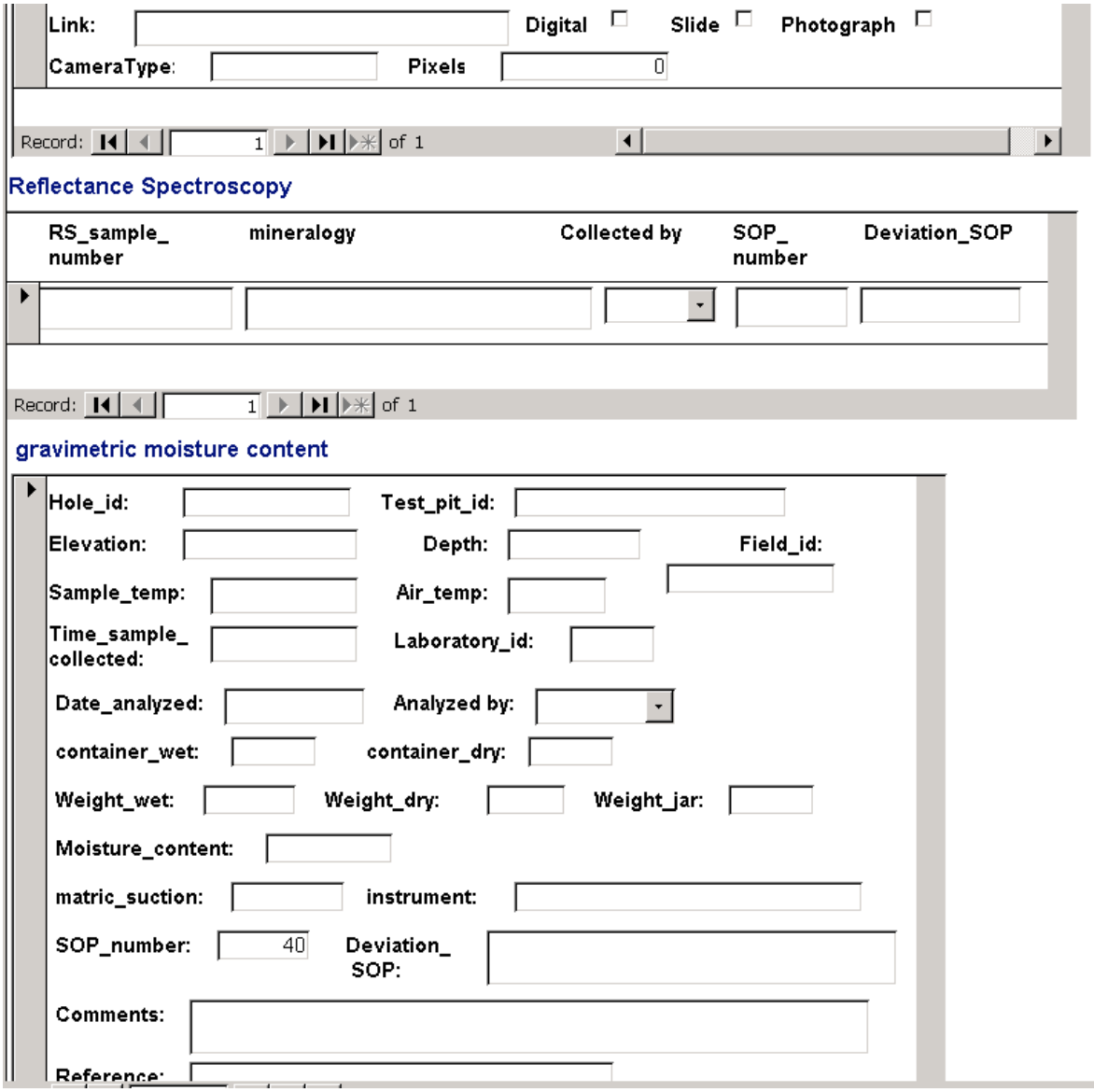
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