

DIGGS

Digital Interchange for Geotechnical and Geoenvironmental Specialists

Development of Geotechnical Data Schema in Transportation



Results Presentation Ohio DOT

June 22, 2012

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Vice Chancellor for IT and Professor Civil Engineering
North Carolina State University

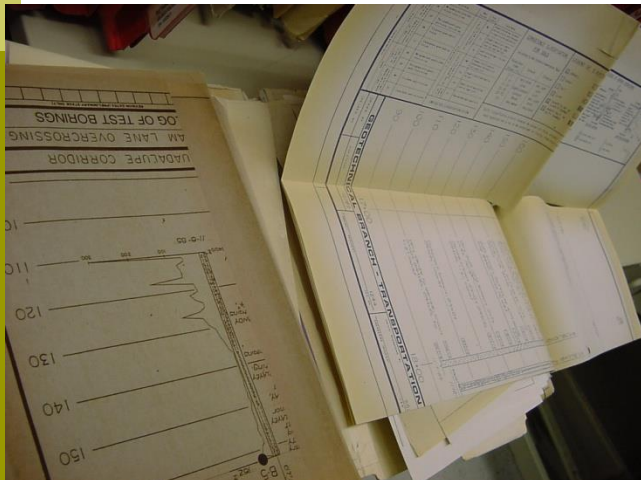
FHWA Pooled fund study TPF-5(111)

Outline

- ❑ Why do we need DIGGS?
- ❑ What is DIGGS?
- ❑ What can DIGGS do?
- ❑ Some examples of software using DIGGS
- ❑ A short technical description of the schema
- ❑ Future of the standard

Caltrans Experience

- 30,000 project files
- 2 million documents
- 300 projects/year
- 80 years of data
- Difficult to access information



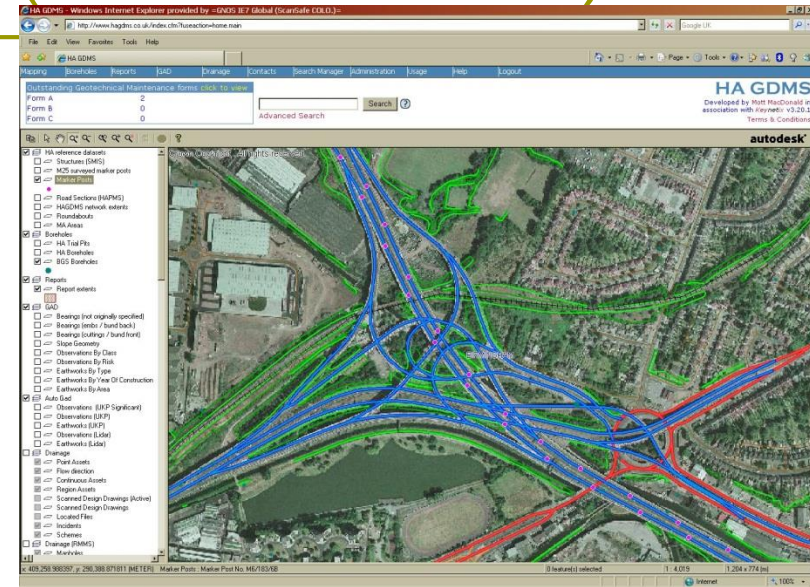
Ohio DOT Experience

- 20-30 person hours per week to retrieve information



The HA Geotechnical Data Management System (HA GDMS)

- Internet-based GIS
- Stores data on:
 - spatial context (mapping and aerial photos)
 - assets
 - reports
 - boreholes
- Supports UK AGS data transfer format
 - data storage/retrieval
 - summary logs
 - summary test sheets



RECORD OF BOREHOLE 25.1

Ground level: 294.411 above G.S. Date of boring: 8/11/01
 Method of boring: SH/T and water Logging tubes: 401 (steel)

Date	Depth	Sample		Description of tests
		Type	Log	
8/11/01	0.00 - 0.10	100	100	100
8/11/01	0.10 - 0.20	100	100	100
8/11/01	0.20 - 0.30	100	100	100
8/11/01	0.30 - 0.40	100	100	100
8/11/01	0.40 - 0.50	100	100	100
8/11/01	0.50 - 0.60	100	100	100
8/11/01	0.60 - 0.70	100	100	100
8/11/01	0.70 - 0.80	100	100	100
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8/11/01	1.50 - 1.60	100	100	100
8/11/01	1.60 - 1.70	100	100	100
8/11/01	1.70 - 1.80	100	100	100
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8/11/01	9.70 - 9.80	100	100	100
8/11/01	9.80 - 9.90	100	100	100
8/11/01	9.90 - 10.00	100	100	100

Scale: 1:1000
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 Approved: [Signature]



AGS Data Committee History

Key dates for the Data Format Committee

1991 -convened in after a conference to discuss electronic data transfer

1992 AGS v1

1994 AGS v2

1999 AGS v3

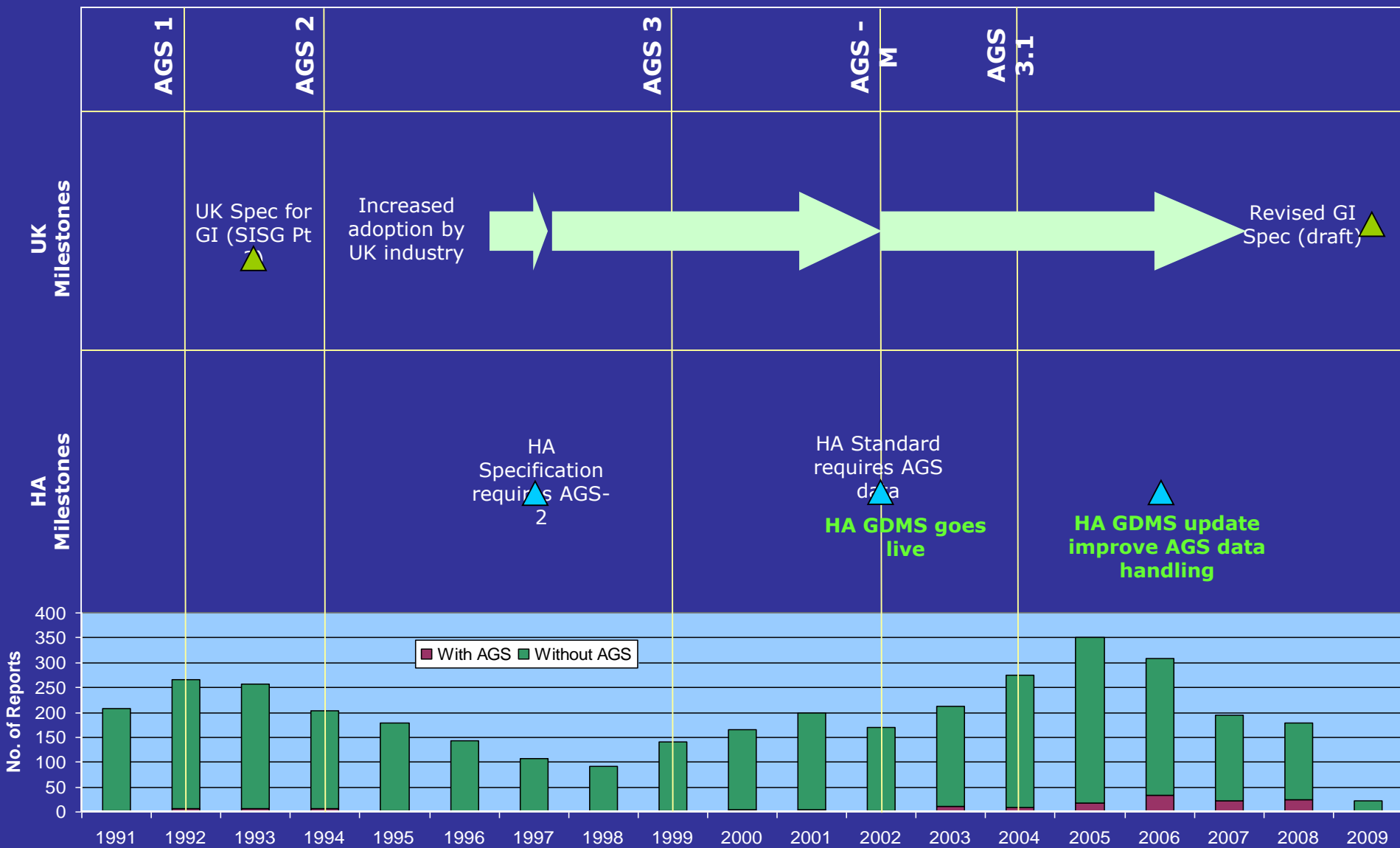
2002 AGS-M

2004 AGS v3.1

2004 Launch of the web site

2008 renamed **Data Management Committee**

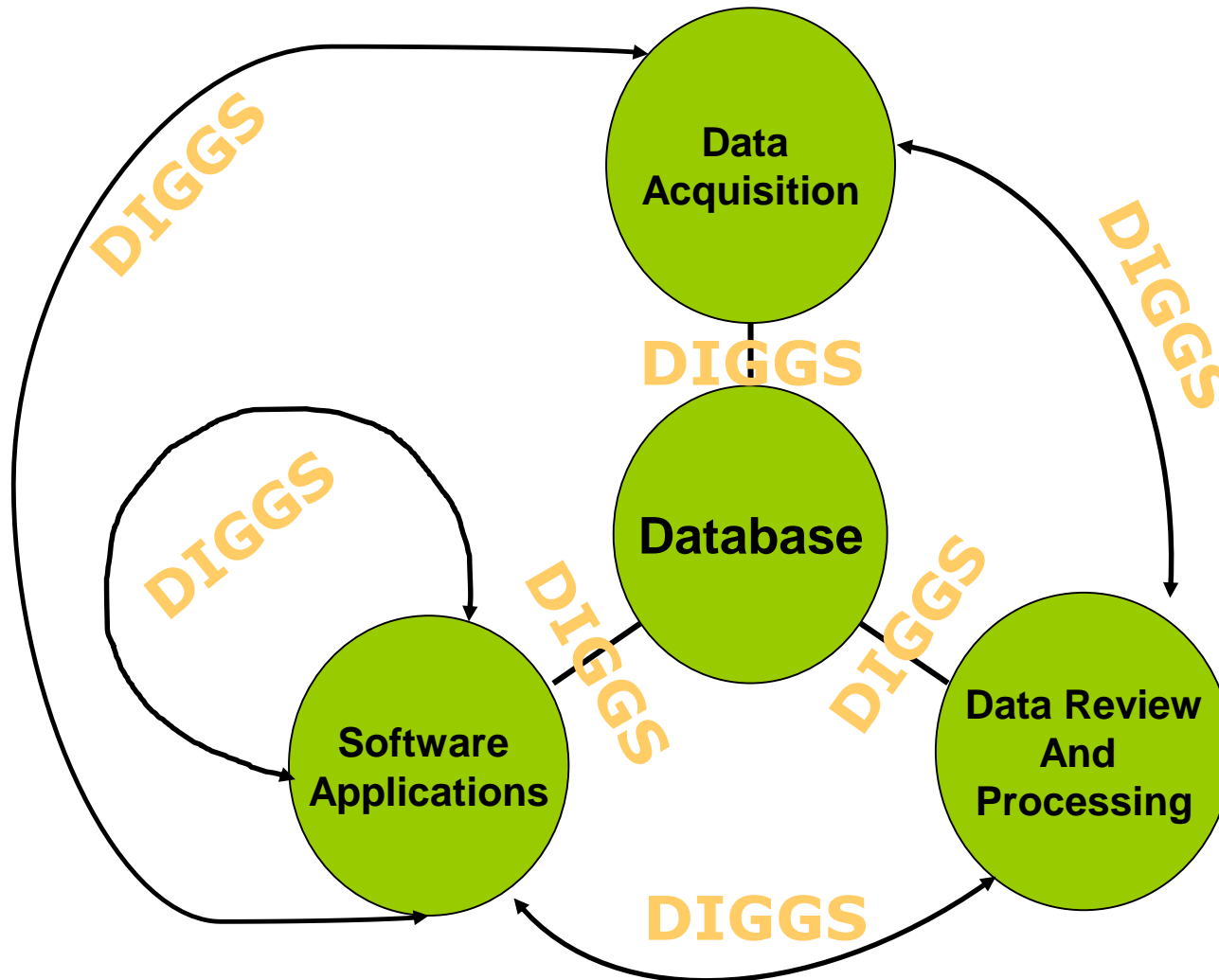
AGS Implementation Timeline



What is DIGGS?

- DIGGS = “Data Interchange for Geotechnical and Geoenvironmental Specialists”
- Standardized international format for the electronic transfer of geotechnical and geoenvironmental data
- Software neutral and non-commercial
- Fully extensible
- DIGGS is not:
 - A software application
 - A database structure

The DIGGS Advantage



Characteristics of DIGGS

- ❑ DIGGS provides a context for different kinds of data that may be related administratively or spatially
- ❑ Transfers data commonly reported as part of a geotechnical investigation
 - Borehole records
 - In-situ test data
 - Monitoring data
 - Laboratory test summaries
 - Geophysical data (Logging)
 - Geoenvironmental data (Water quality & Testing)

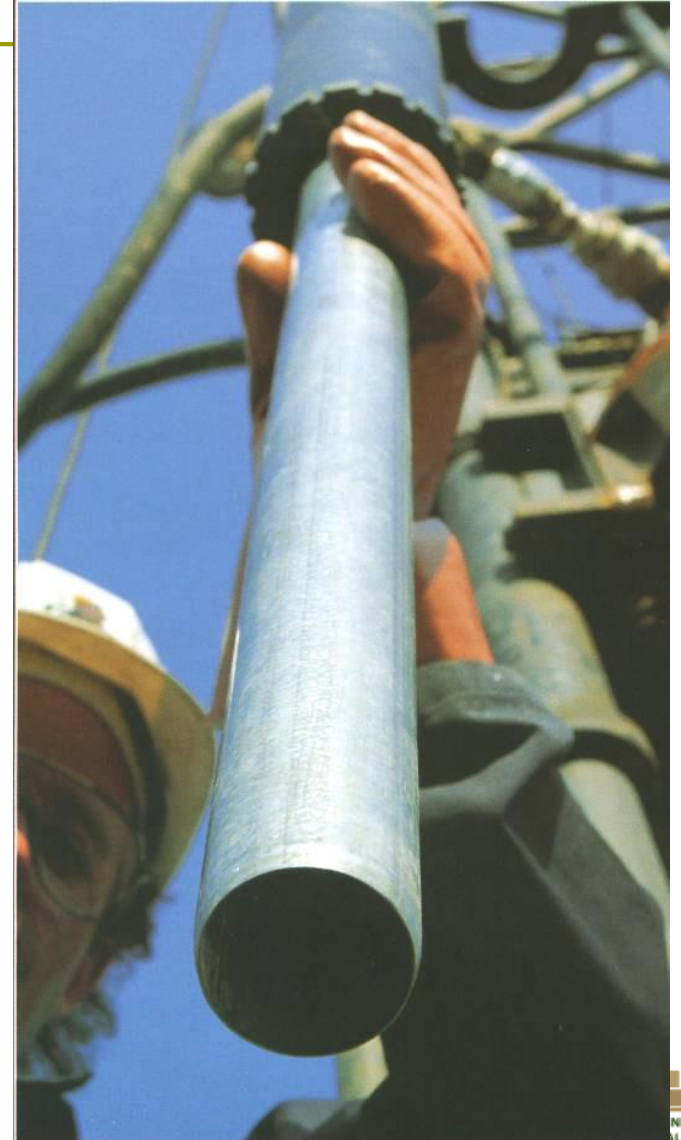
Key Activities

- Borehole Data
 - Point Location
 - Drilling Operations



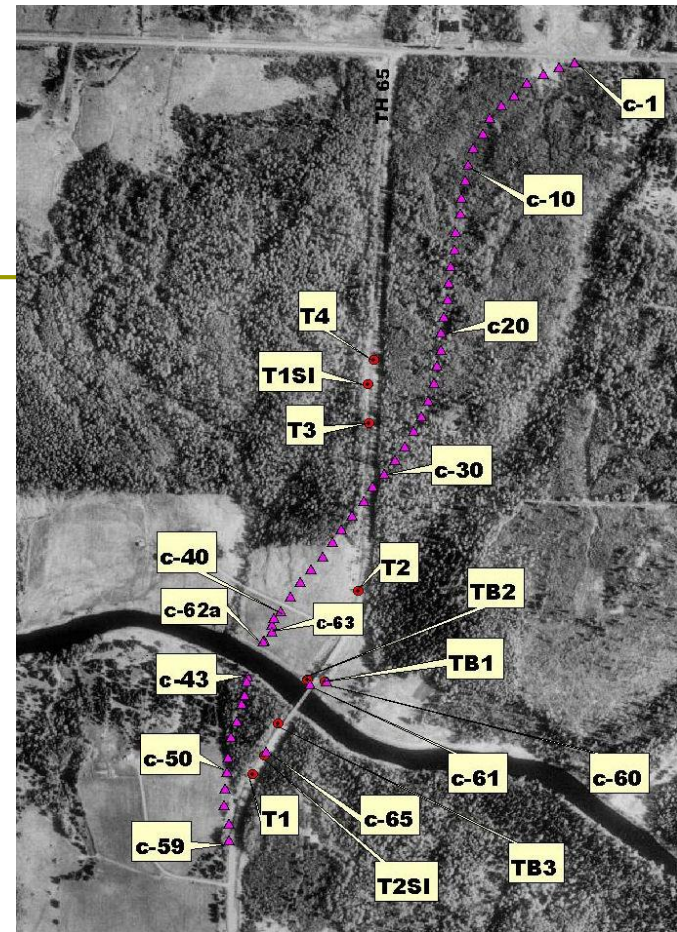
Key Activities

- ▣ Borehole Data
 - SAMPLES!



Data TRANSFER

- Site Information
- Depth Information
 - Field
 - Lab Testing
 - Soil and Rock



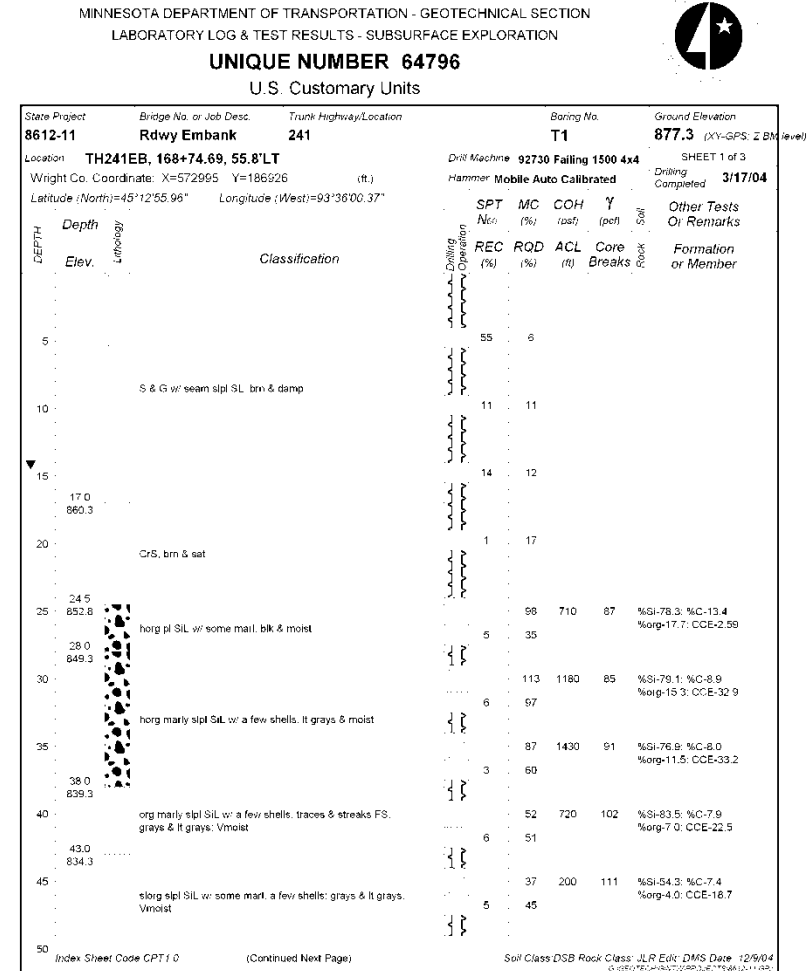
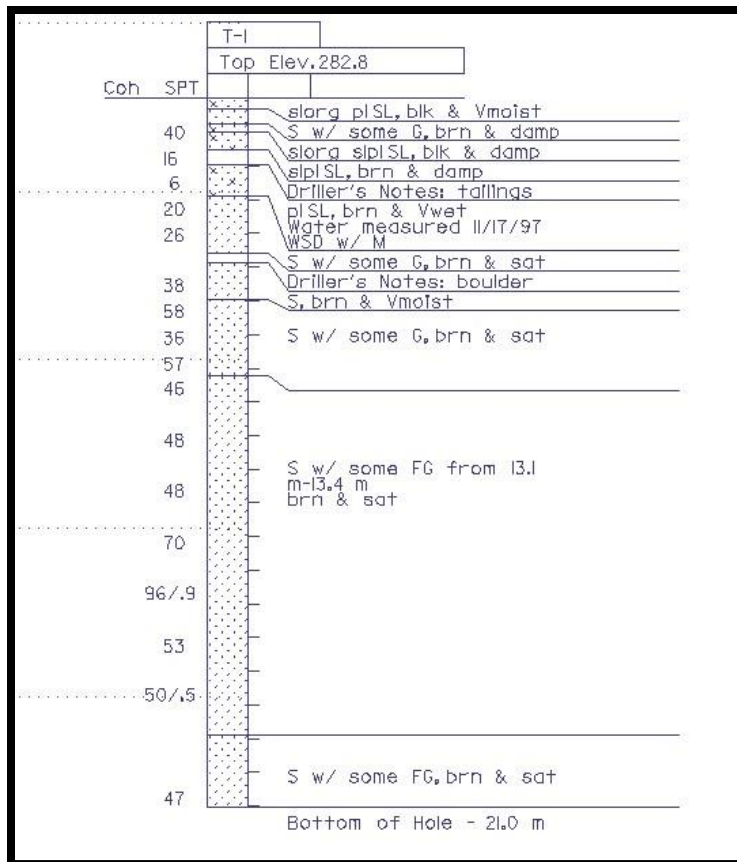
Data TRANSFER

▣ Lab Data (results and/or test data)



Logs and Log Data

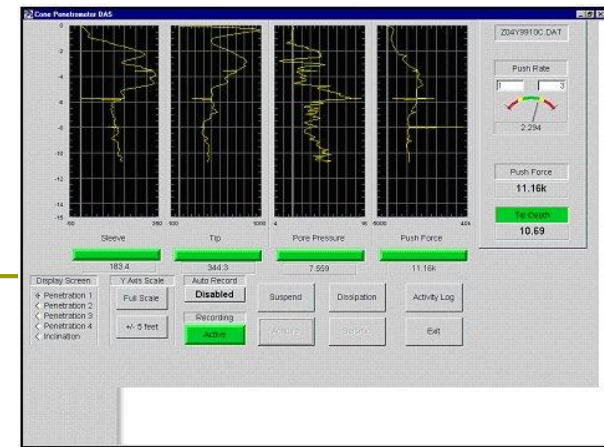
Electronic / Paper



Data TRANSFER

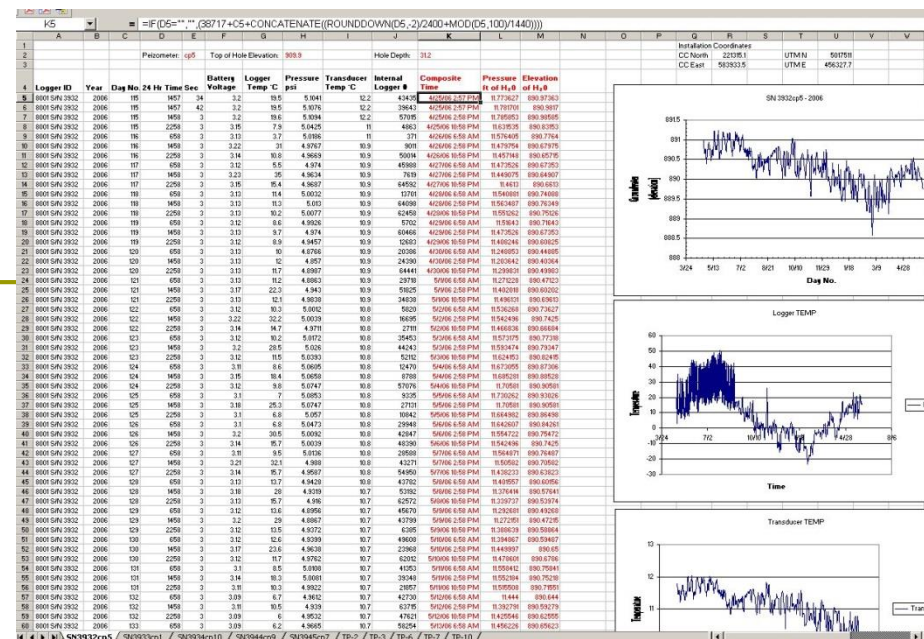
□ Borehole data

- From field to office
- Intraoffice (among software)
- Interoffice (among staff)
- From office to External



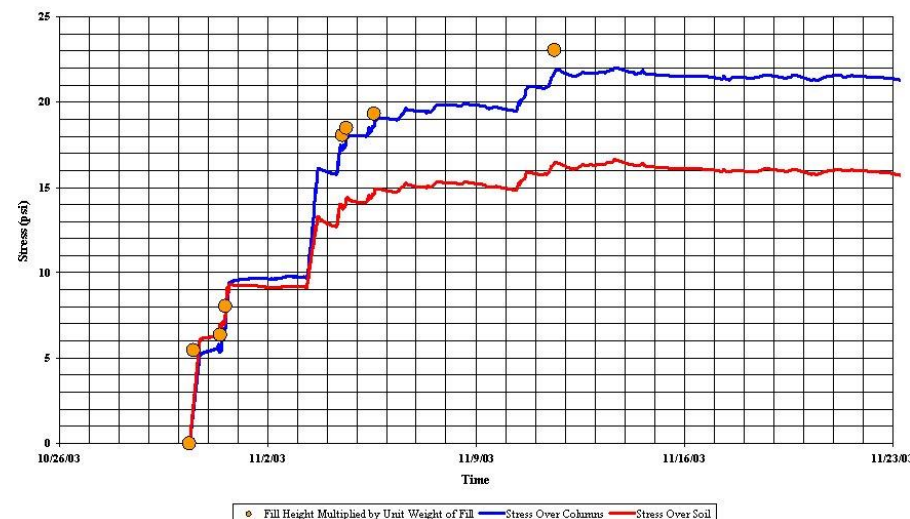
Sensor Data

- Manual
- Automated



A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Piezometer TP-10 Information:													
2	Location: TH 169, (US Bank)													
3	Depth of H2O from top of Riser Pipe, A inches	To be measured												
4	Ht. of casing from GL, B inches	24												
5	Top of Riser Pipe to top of casing, C inches	4.75												
6	Size of plumb bob (inches)	5.875												
7	Ground Level Elevation	383.4												
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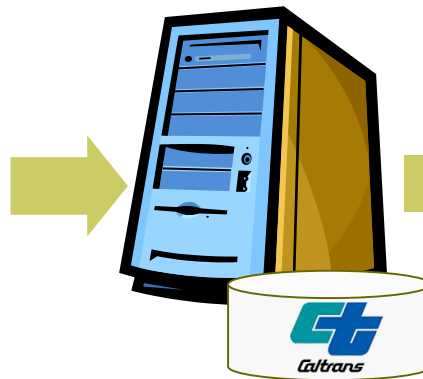
Pressure Cell Time-History



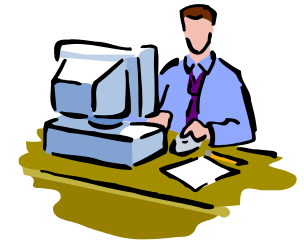
Workflow within an Organization



Data is collected in the field electronically



Data files are transferred to a central repository



Design Engineer

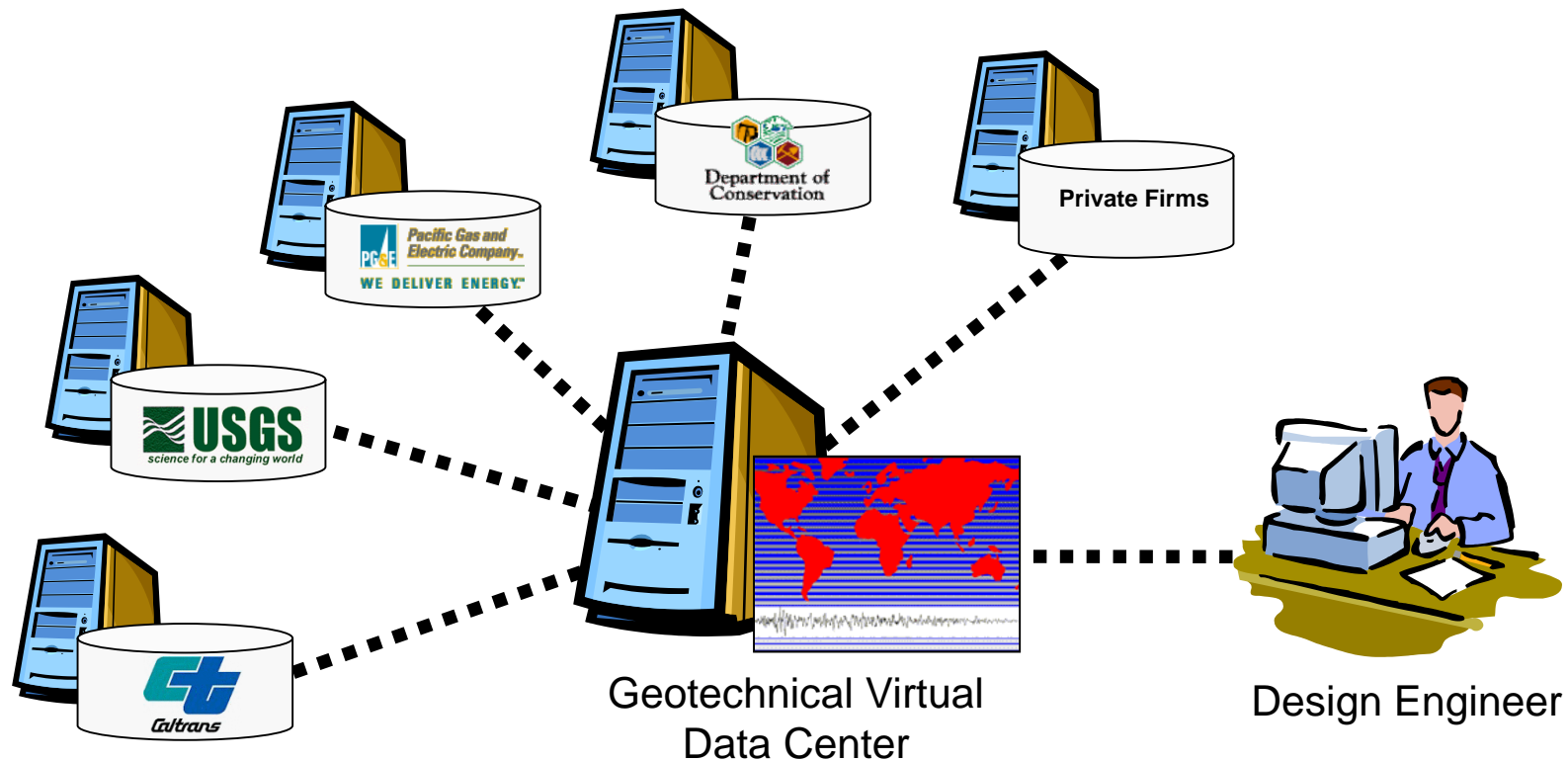


Drafter



Other Staff

Connection to Multiple Data Sources



Cost Savings

- ❑ Ohio DOT:
 - 10-20% less drilling, savings \$12-24M per year
- ❑ Florida DOT:
 - Fewer borings saving \$250,000 - \$500,000 on one project
- ❑ Missouri DOT:
 - 10-15% fewer borings per bridge
- ❑ Missouri DOT:
 - \$81,000 savings per year in boring log preparation by using electronic data entry in the field
- ❑ California DOT:
 - 20% savings (\$200k/year) with laboratory data management system implementation

DIGGS Research Objective

- ❑ **Develop a standard XML schema and data dictionary for geotechnical data**
 - Survey of GMS stakeholders to identify specific geotechnical data needs (at dictionary level).
 - Survey based on previous standards by AGS, COSMOS, UF-FDOT, and EPA
 - Results were used to develop a consensus to define the international standard XML (GML compliant) data interchange format schema.
 - Majority of the effort was in agreement on definitions and XML structure.

Characteristics of DIGGS

- Extensible Mark-Up Language (XML)
- XML Schema Definition (XSD)
 - Normative document
 - Defines elements
- Standard for internet data transfer
 - Platform independent
 - Tools available for validating, querying, processing, displaying, and transforming

DIGGS Evolution

- ❑ Pooled Fund Study to create DIGGS
 - TPF-5(111), started 2005 (managed by Ohio DOT)
 - Merger of existing XML standards:
 - ❑ AGS standard (UK)
 - ❑ COSMOS standard (CA, Earthquake group)
 - ❑ FDOT/UF Pile standard
 - GML Compliant (International Geo-Spatial XML standard)
 - Version 2 is final result from study (June 2012)
 - Partners: AGS, COSMOS, EarthSoft, EPA, FHWA, GINT, KeyNetix, UK-HA, UF, USGS, State DOTs

Research Scope and Phasing

❑ Original Proposal:

- Phase I – Develop survey (dictionary and XML schema based on AGS, COSMOS & UF-FDOT)
- Phase II – Complete dictionary and schema using workshops and volunteer effort
- Phase III – Add special interest groups for new areas

❑ Final structure – Two major stages:

- Stage 1 – Original Phase I, most of Phase II and part of Phase III
- Stage 2 – Contract with GML expert to convert Stage 1 results into the final schema

Initial Collaboration Meeting



May 2005

Development History

Meeting	Purpose	Date	Outcomes
Pre-planning	Develop consensus on basic structure of schema	May 16-17, 2005, Atlanta, GA	Draft schema structure and plans for proposal
First Workshop	Schema outline & Data dictionary for data in existing systems. Dates, Deadlines and Deliverables	August 10-13, 2005, San Francisco, CA	Schema team and dictionary team, refined schema structure, data dictionary,
Second Workshop	Continue development of schema and dictionary	November 18, 2006, Orlando, FL	Draft schema, dictionary and users guide for presentation to GMS
GMS Meeting	Update governing body on progress and get approval for directions	January 18-19, 2006, Atlanta, GA	Approved
AGS Meeting	Develop plan to improve progress	March 2007, UK	Move to UML version with now tool to automate schema creation for consistency
Workshop V1.0 review	Review release candidate for V1.0 and plan final corrections – using new UML tool system	September, 2007, Boston, MA	Set actions, assignments and tasks to finalize V1.0 – set release for spring 2008
Invitational Workshop	Present and approve new directions for DIGGS	Orlando Florida, March 25-26, 2009	Approved new timeline, consultant for final stages, plan for permanent governance/ownership
Consultant hired	Send RFP and hire consultant	August 2009	Galdos Hired to complete Schema
Update Schema to v1.1	Consultant completes v1.1 – working with GDC members and Loren Turner – weekly calls	May 19, 2010	V1.1 released
Completion of v2.0a	Consultant delivers v2.0a schema, dictionary and report	June 30, 2012	V2.0a released
Final Transfer Workshop	Transfer DIGGS to ASCE-GeoInstitute, develop implantation proposal to ODOT	June 22-23, 2012, SF, CA	Developed proposal to ODOT for new funding to transfer schema to ASCE-GeoInstitute and make available to community.

Five Examples of DIGGS in Use

□ Public

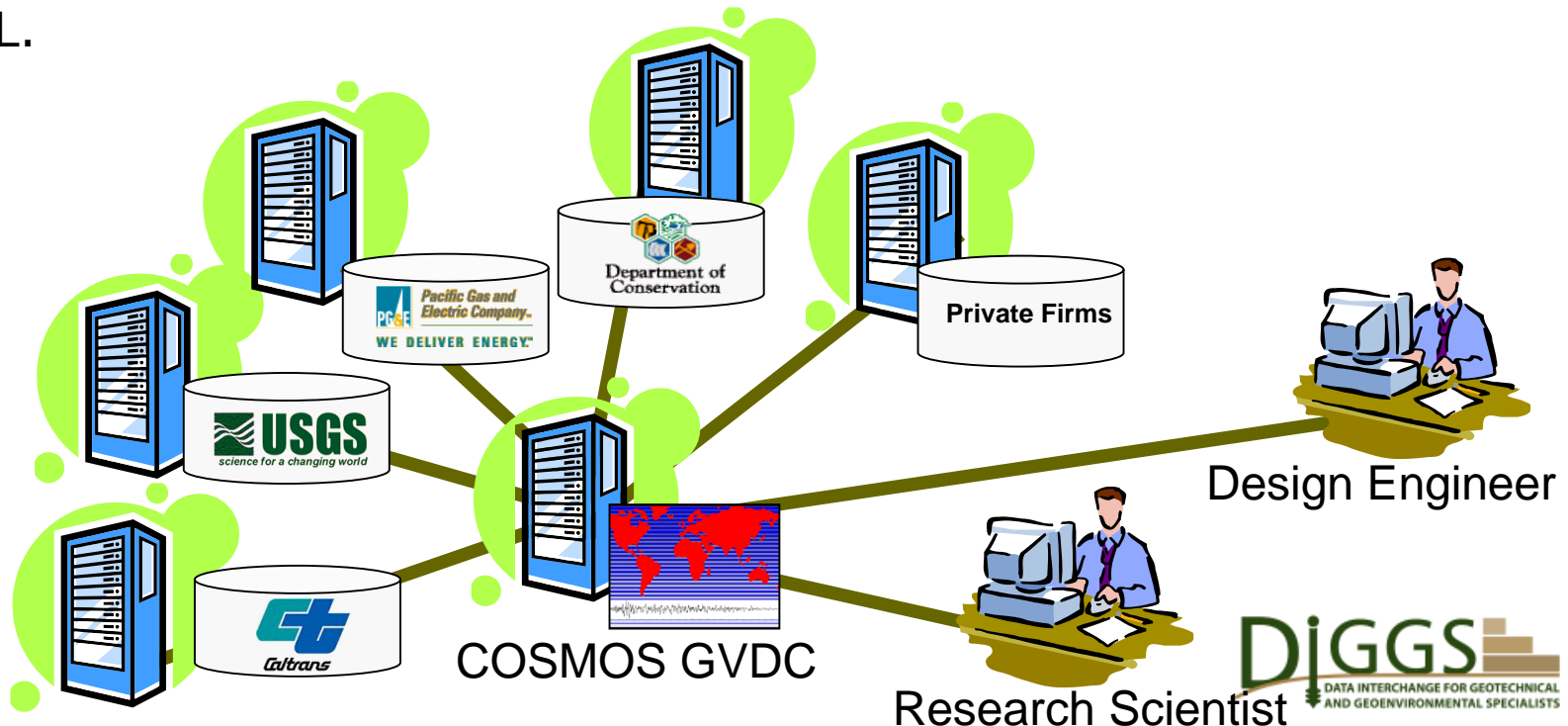
- CalTrans – Virtual Data Center
- Florida DOT – Geotechnical Database

□ Commercial

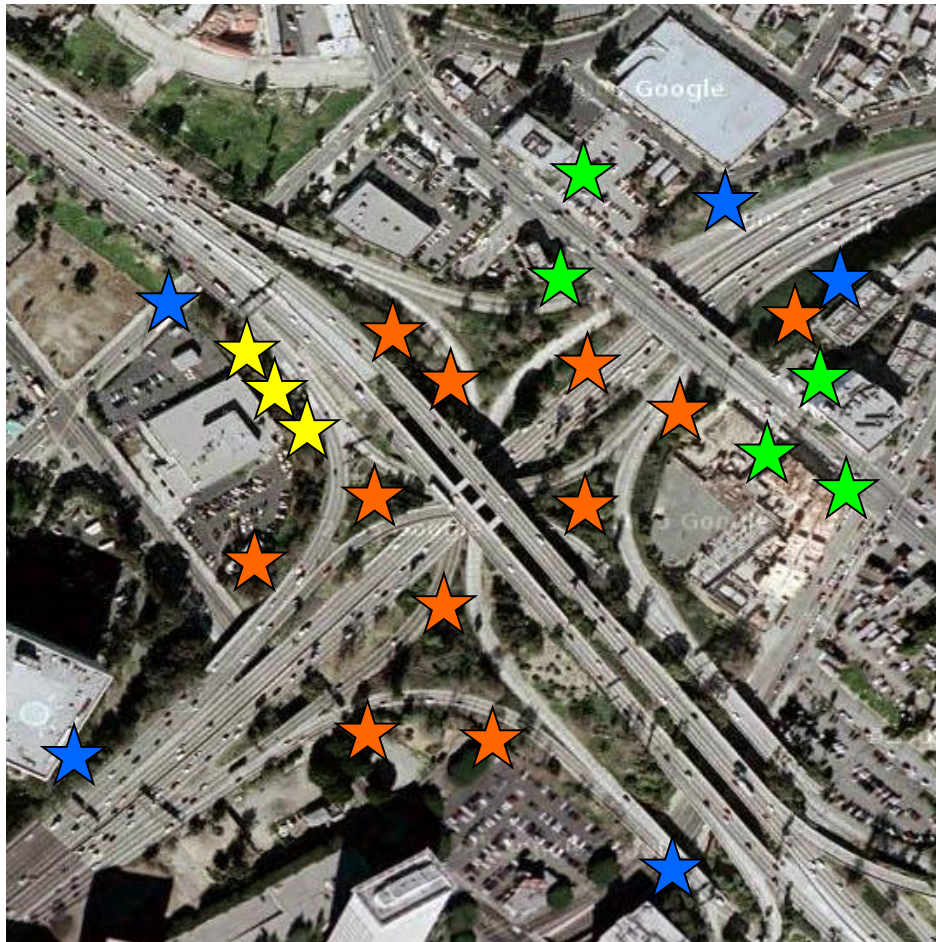
- Earthsoft - Equis
- Gint
- KeyNetix - Holebase

Geotechnical Virtual Data Center

- The GVDC is a web application that acts as a “broker” for geotechnical data. It is not a data repository.
- Data is held by registered data providers who maintain their data in their own proprietary systems, and make available to the GVDC only the data they choose.
- Data is transmitted to the end-user via the GVDC as DIGGS XML.

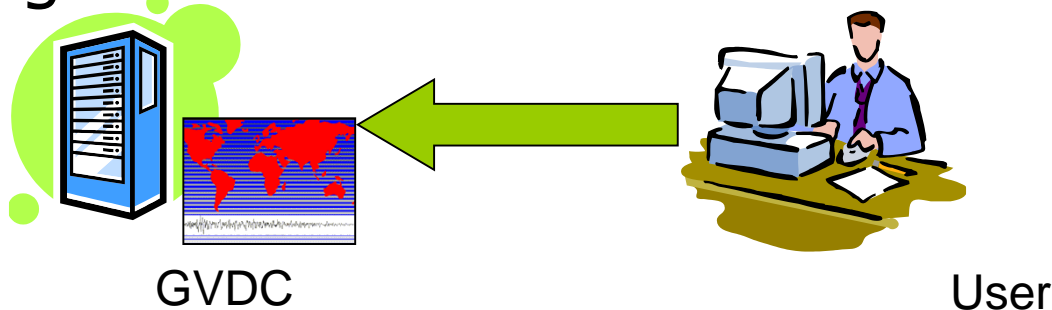


Virtual Data Center

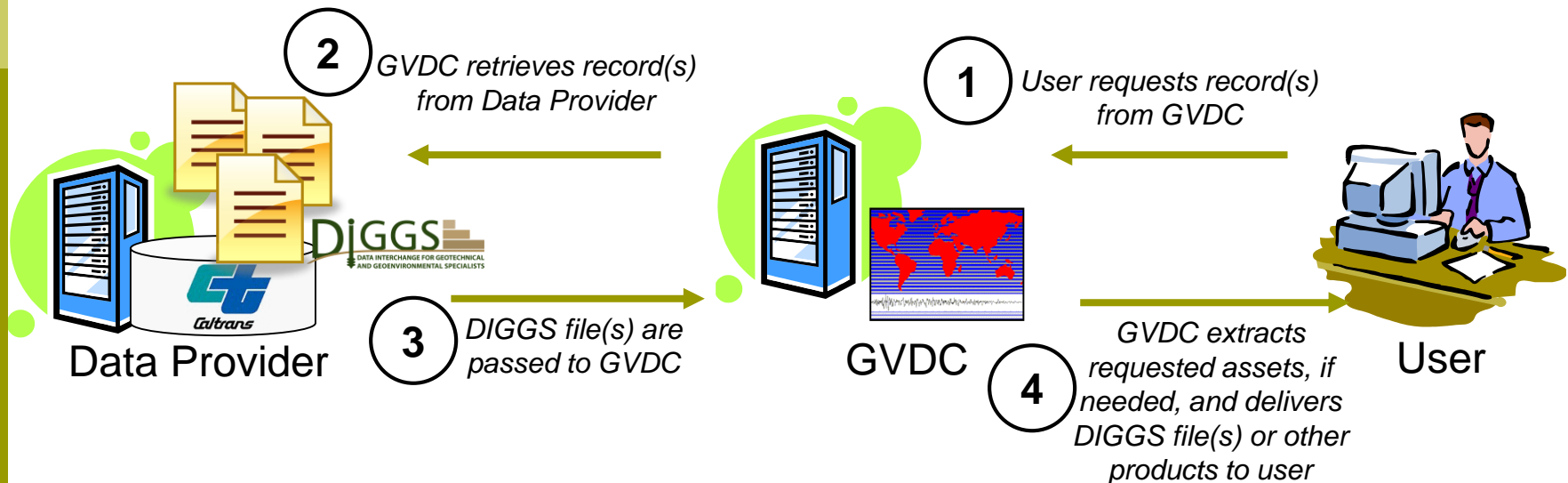


User Experience

- A user goes the GVDC to search for data



- The user requests to download and/or preview the record(s) returned by the search process.



COSMOS/PEER-LL



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PROJECT INFO

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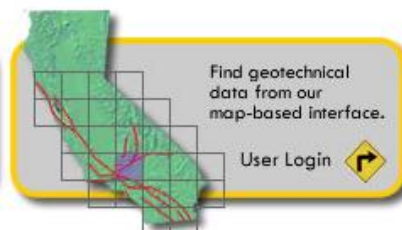
Geotechnical Virtual Data Center (GVDC)

The overall project is divided into a short-term and a long-term objective. The project we are now undertaking encompasses the short-term objective only, to develop a pilot web-based system linking the PG&E, Caltrans, CGS and USGS example geotechnical data sets. The long-term objective (a future project not yet funded) is to extend the pilot system and develop a web-based system linking multiple data sets... [read more >>](#)

Please see the Project Workshop agenda, June 21-23 '04 in Newport Beach, CA. The results of the user scenario survey [more >>](#)

The objective is to develop consensus recommendations for classifying, archiving, and web dissemination of geotechnical data... [more >>](#)

COSMOS and the PEER Lifelines Program are coordinating additional workshops and establishing a pilot project leading to... [more >>](#)



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- [CalTrans](#)
- [California Energy Commission](#)
- [Pacific Gas & Electric](#)
- [PEER-Lifelines Program](#)

In Partnership with:

- [Pacific Earthquake Engineering Research Center](#)
- [United States Geological Survey](#)
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- [University of Southern California](#)
- [Consortium of Organizations for Strong-Motion Observations Systems](#)



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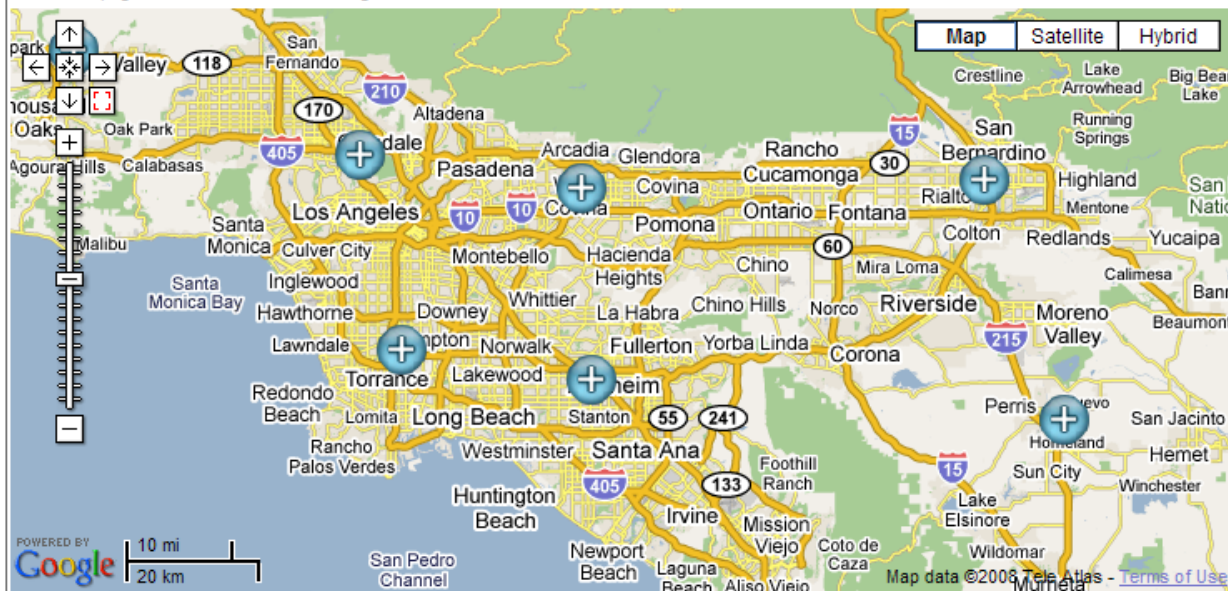
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Latitude: -116.90826416015625 Longitude: 33.911454454267606

Search

Provider - All Providers -

Project Date(mm/dd/yyyy)

from to

Asset
NameProject
NameBorehole
Depths

min max

Boundaries

(decimal degrees)

Longitude min

Longitude max

Latitude min

Latitude max

Search for Selected Data Types ☒ All Checked by Default

Results Per Page 60

search

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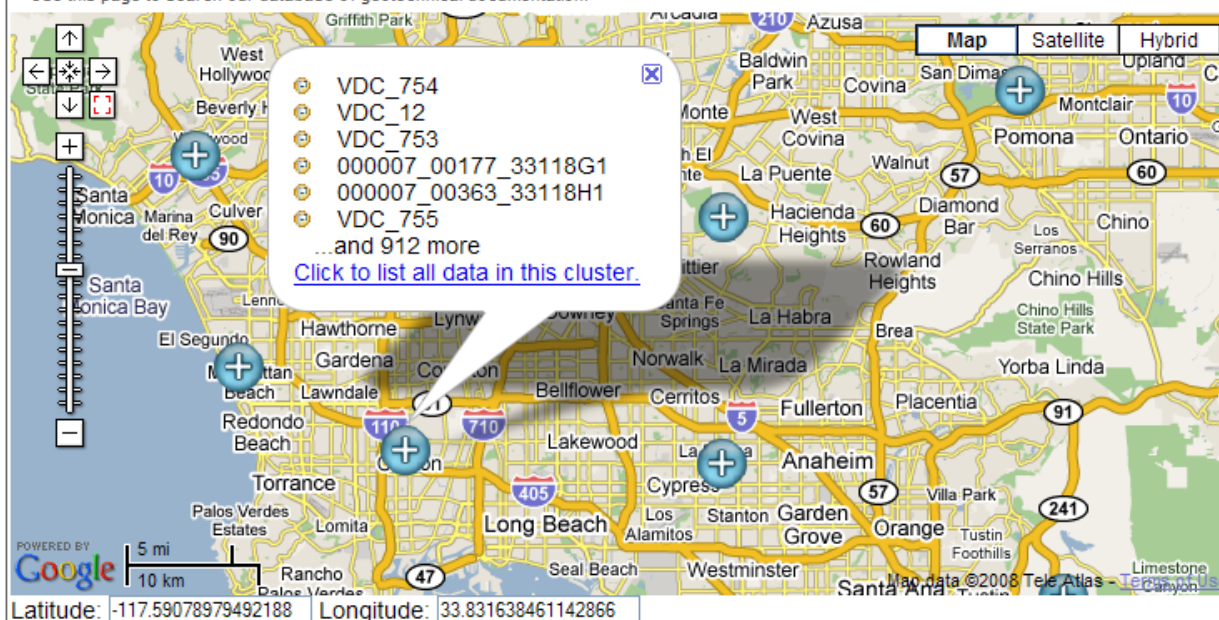
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Search for Selected Data Types ☒ All Checked by Default

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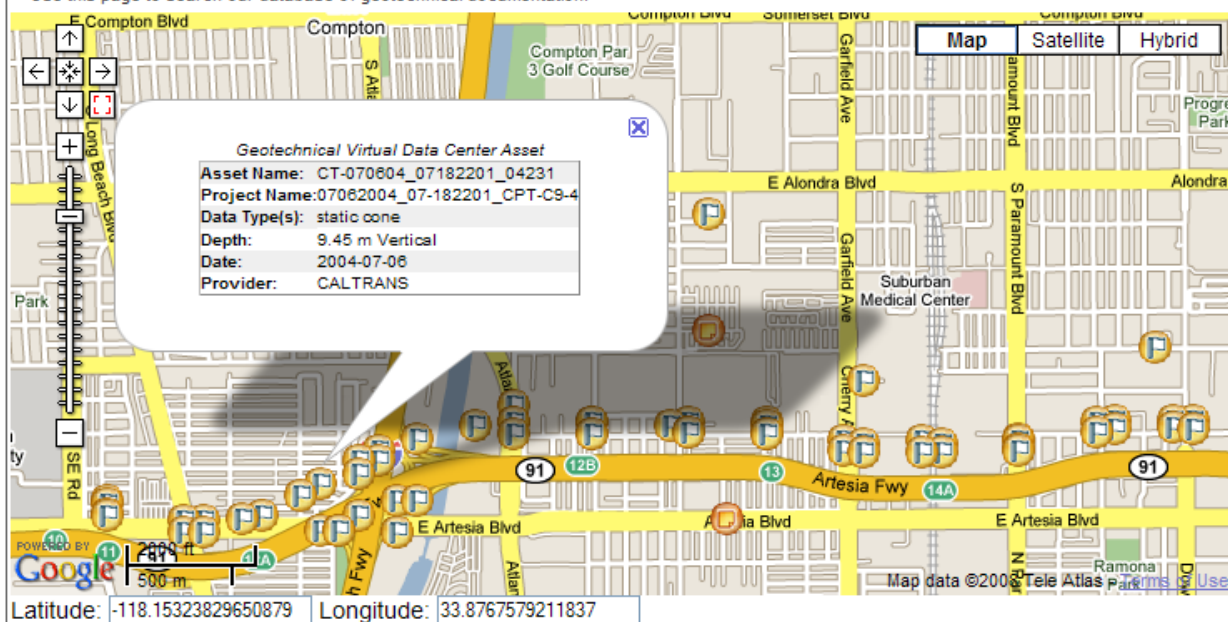
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Asset
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Boundaries

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Search for Selected Data Types ☒ All Checked by Default

Results Per Page 60

search

Location Description				
Latitude	Min :		Max:	
Longitude	Min :		Max:	

COSMOS: Station USC: Long Beach, CA, Long Beach LDS Church, 6979 Orange Ave - Mozilla Firefox

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COSMOS /PEER-LL COSMOS: Station USC: Long Beac...

COSMOS VIRTUAL DATA CENTER

Consortium of Organizations for Strong-Motion Observation Systems

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USC: Long Beach, CA Long Beach LDS Church 6979 Orange Ave

Agency Number: 5380
Latitude: 33.8810
Longitude: -118.1760
Site Geology: Alluvium [QYM Q](#)
Owner: University of Southern California
[References](#)

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Whittier Narrows, California 1987-10-01 14:42:20 UTC

[Summary page for this earthquake](#)

☐ Add this station record to the download bin

Component: Up	PGA (cm/s/s): 132.70	PGV (cm)
Component: 10	PGA (cm/s/s): 221.50	PGV (cm)
Component: 280	PGA (cm/s/s): 152.50	PGV (cm)

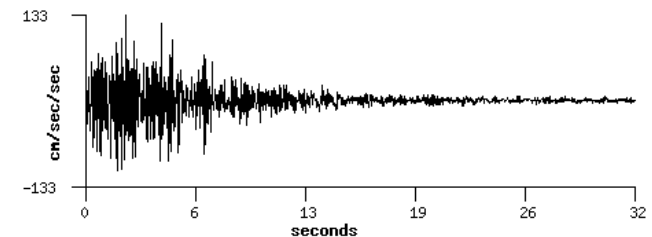
[Return to top](#)

Landers, California 1992-06-28 11:57:34 UTC

[Summary page for this earthquake](#)

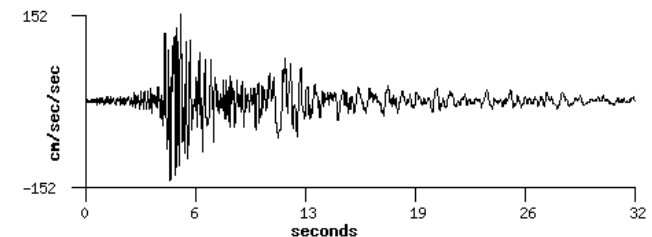
☐ Add this station record to the download bin

Component: Up	PGA (cm/s/s): 19.70	PGV (cm)
Component: 10	PGA (cm/s/s): 48.40	PGV (cm)
Component: 280	PGA (cm/s/s): 58.70	PGV (cm/s): -



Component: 280

Ground Level



☐ Add this to bin

COSMOS/PEER-LL

[Home](#)[Search](#)[Account](#)[Data Provider](#)[Administrator](#)[Help](#)[Log Out](#)

Document Search Results

This page displays the results of your search of our geotechnical documentation database.

Your search returned data sets from the following data provide

[CALTRANS \(490\)](#)

[CGS \(358\)](#)

[USGS \(971\)](#)

Records shown 1 - 60 of 358

1 2 3 4 5 6 [Next >>](#)

Data From CGS

Asset Name (1)	Project Name (2)
000002_00043_33117G8	ARCO Former Station No. 1385
000002_00049_33117H8	Shell Station
000002_00050_33117G8	Exxon Station 7-2314
000002_00052_33118G1	Texaco U.S.A.
000002_00053_33117H8	Mobile Service Station No. 11-H9N
000002_00054_33118G1	Gateway Chevrolet
000002_00055_33117G8	Williams Volvo
000002_00058_33117H8	Nutrilite
000002_00080_33117H8	Pomona Box Company
000002_00084_33117H8	Fast Fuel Station No. 971
000002_00085_33117H8	Fast Fuel Station No. 971
000002_00087_33118G1	Bergen Brunswick Drug Company
000002_00071_33117G8	G and M Oil (50978)
000002_00073_33118G1	Unocal Station No. 5599
000002_00075_33117H8	Los Coyotes Country Club
000002_00078_33117G8	Percy Owens Estate

[Close](#)

[Map](#) [Satellite](#) [Hybrid](#)

Geotechnical Virtual Data Center Asset

Asset Name: 000002_00058_33117H8

Project Name: Nutrilite

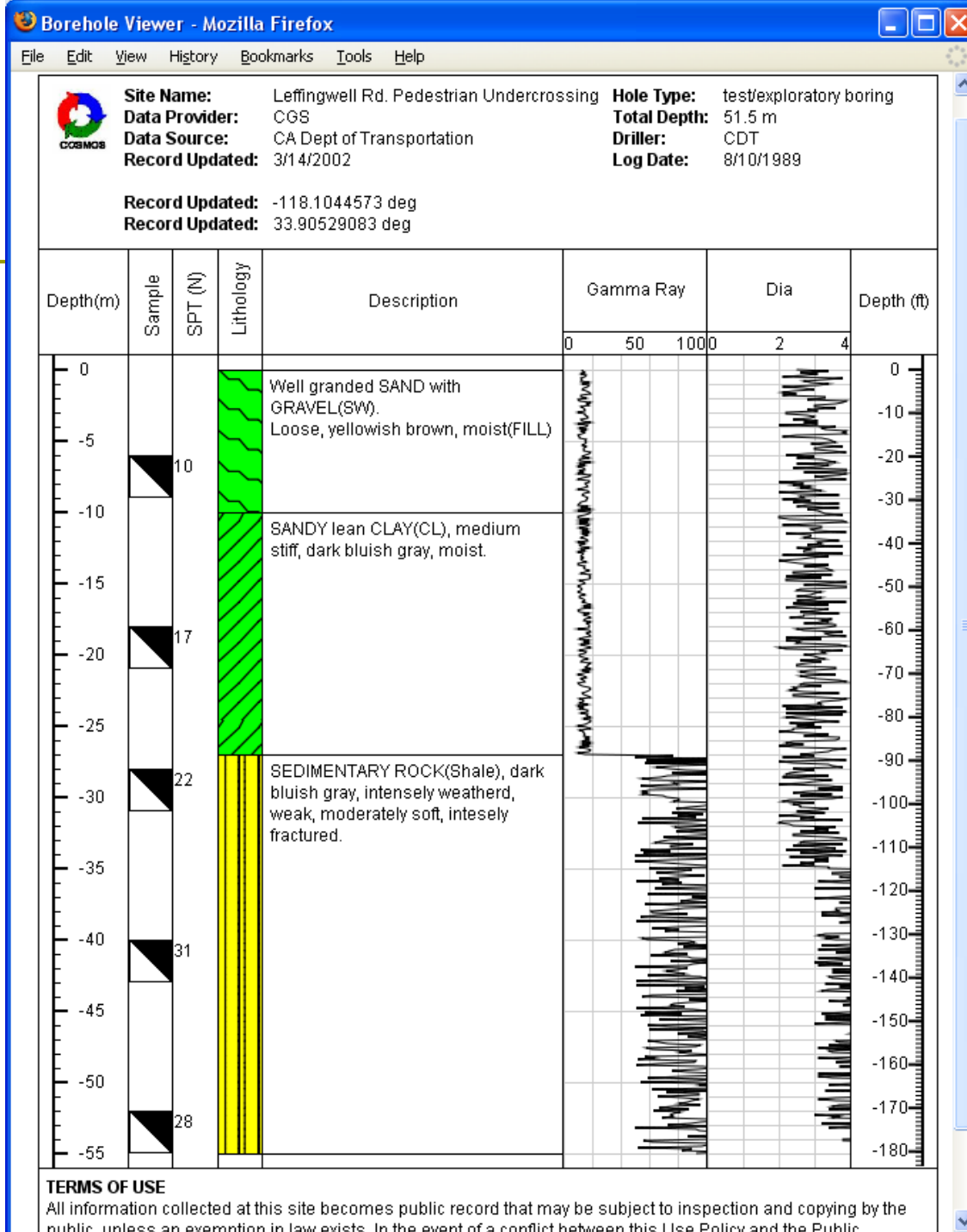
Data Type(s): water level
lithology

Depth: 55 ft Vertical

Date: 1989-12-10

Provider: CGS

31.5 ft vertical	1989-12-10	<input type="checkbox"/>
20 ft vertical	1989-12-10	<input type="checkbox"/>
15 ft vertical	1989-12-10	<input type="checkbox"/>
16.5 ft vertical	1989-12-10	<input type="checkbox"/>
55 ft vertical	1989-12-10	<input type="checkbox"/>
31.5 ft vertical	1989-12-10	<input type="checkbox"/>

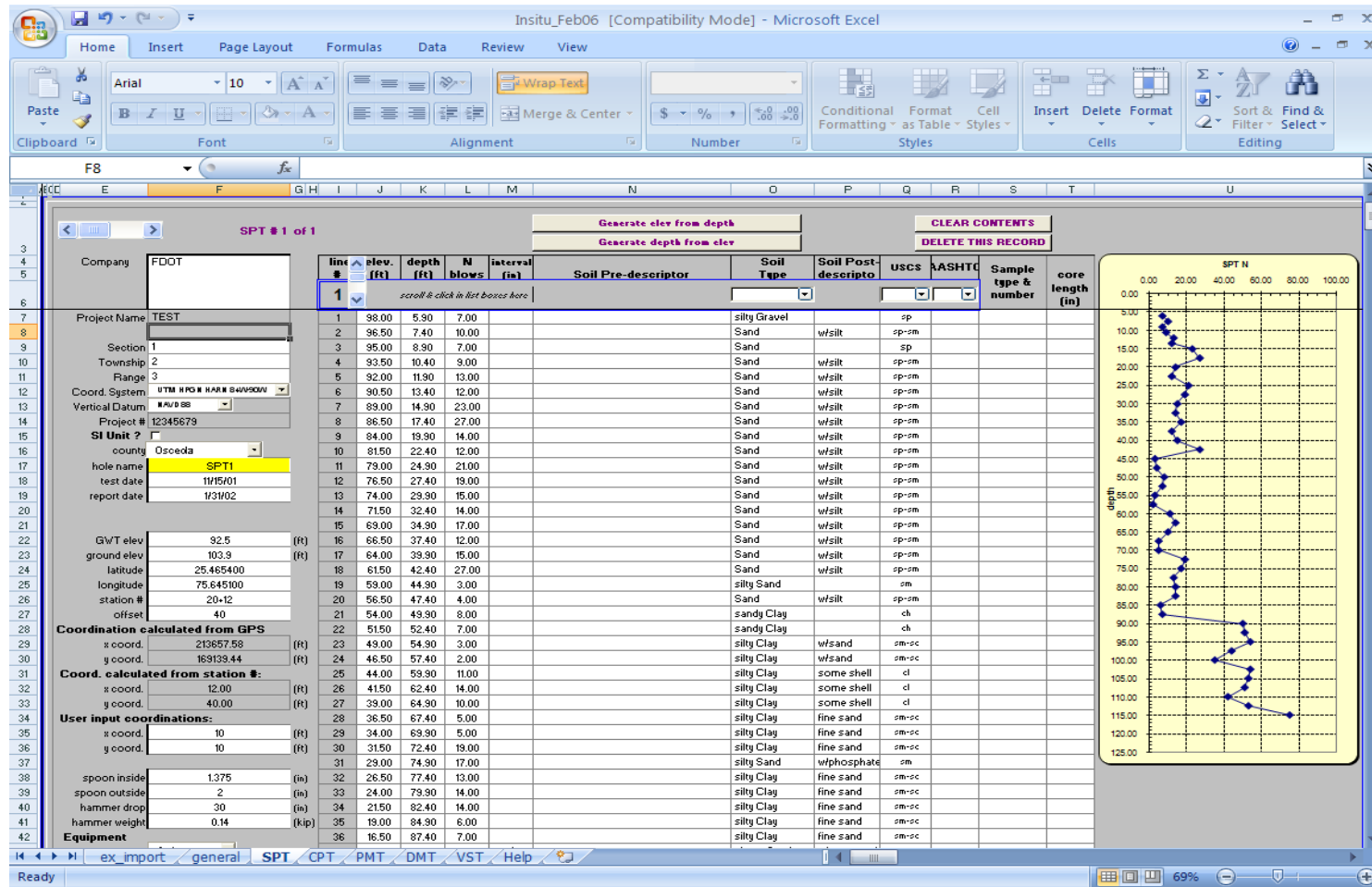


Florida

- ❑ FDOT Geotechnical Database
- ❑ Bridge Software Institute (BSI) has developed three unique pieces of software that can access the database
 - FB-Deep
 - Pile Technician
 - Database Spreadsheets
- <http://bsi-web.ce.ufl.edu>



Example of In-situ spreadsheet



EarthSoft Data Management Software

❑ **Environmental Quality Information System (EQuIS)**

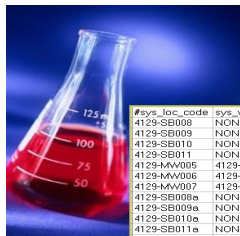
- ❑ The most widely used system in the world for managing technical sample data:
 - ❑ Groundwater
 - ❑ Surface Water (Stream or Lake/Reservoir)
 - ❑ Geology / Geotechnical
 - ❑ Meteorological
 - ❑ Air
- ❑ Data Quality first, then Data Usability
- ❑ Open System

EQuIS Data Management Software

Field Data Collection



Monitoring/
Instrumentation


#sys_loc_code	sys_well_code	X_coord	Y_coord
4129-SB008	NONE	620071.4841	7339792.757
4129-SB009	NONE	620095.495	7339809.48
4129-SB010	NONE	619666.5208	7339949.574
4129-SB011	NONE	619505.707	7339908.768
4129-MV005	4129-MV005	619443.7651	7339953.166
4129-MV006	4129-MV006	620133.2989	7340195.292
4129-MV007	4129-MV007	620162.5517	7340127.655
4129-SB008a	NONE	620071.4841	7339792.757
4129-SB009a	NONE	620095.495	7339809.48
4129-SB010a	NONE	619666.5208	7339949.574
4129-SB011a	NONE	619505.707	7339908.768
4129-MV005a	4129-MV005	619443.7651	7339953.166
4129-MV006a	4129-MV006	620133.2989	7340195.292
4129-MV007a	4129-MV007	620162.5517	7340127.655

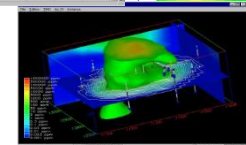
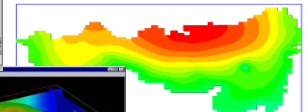
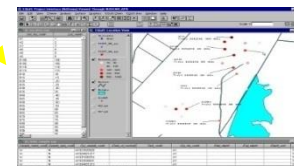
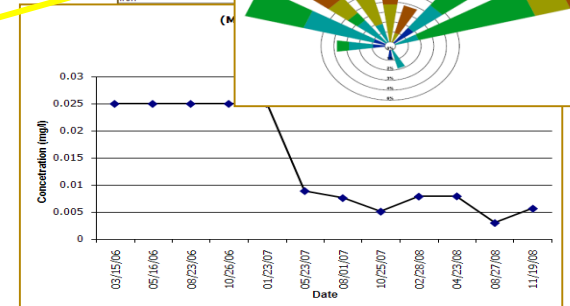
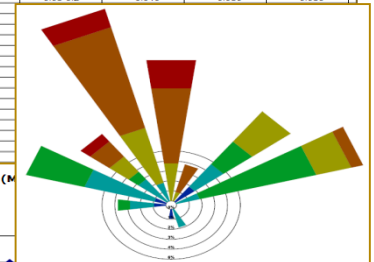
Laboratory
EDDs

EDP

EQuIS 5

Data In,
Information Out

Barrick Bald Mountain Mines Inc.				
Sample Location:	BMM Well - 1			
Location Code:	Well-1			
Reporting Period:	4th Qtr. 2008			
Permit No.:	NEV50045			
Lab Name:	SVL	SVL	3rd Qtr	
Lab Reference No.:	C08020752	W803113	SVL	
Sample Date:	02/19/2008	06/11/2008	W830224	
Lab Test Date:	02/19/2008	06/11/2008	09/15/2008	
Sampled By:	Nick/Tina	Trey	09/15/2008	
Constituent	Standards (mg/l)	1st Qtr.	2nd Qtr.	3rd Qtr.
Aluminum	0.05-0.2	< 0.10	< 0.10	< 0.10
Antimony				
Arsenic				
Barium				
Beryllium				
Bicarbonate				
Boron				
Cadmium				
Calcium				
Carbonate				
Chloride				
Chromium				
Copper				
Cyanide (WAD)				
Fluoride				
Iron				



gINT – Geotechnical Data Management System

- ❑ Geoenvironmental and geotechnical software for reporting, managing and storing data
- ❑ Customizable:
 - borehole/boring
 - well logs
 - fence diagrams
 - geotechnical testing

gINT - Examples

INPUT - y:\projects\environmental solutions\events\20120625 diggs\images for marc\gint std ags 4_0.gpj POINT table Library: g:\gint custom work\special apps

File Enterprise Additional Modules Edit Format Tools Tables gINT Rules Navigation Help

INPUT OUTPUT DATA DESIGN REPORT DESIGN SYMBOL DESIGN DRAWINGS UTILITIES

Show tabs [Main Group group] Table Help

Location identifier	Final depth (m)	Type of activity	Local east (m)	Local north (m)	Local ground Level (m)	Start date	End date	Remarks
B-1	14.10	RO	548344.90	418196.30	37.60	5/16/2012	5/17/2012	NW corner of tank farm lot
B-2	14.10	SCP	548447.20	418203.20	38.25	5/17/2012	5/18/2012	
B-3	7.50	DCP	548425.00	418088.00	10.89	5/18/2012	5/19/2012	Hole located 15m north of railroad
B-4	9.50	RC	548369.00	418102.90	16.23	5/19/2012	5/20/2012	
B-5	20.00	RO	548385.70	418097.40	9.87	5/20/2012	5/21/2012	Chiselled 1 - 1.5m
B-6	20.00	RO	548415.40	418110.20	16.52	5/21/2012	5/22/2012	Chiselled 1 - 1.5m
B-7	20.00	RO	548463.40	418105.10	20.42	5/22/2012	5/23/2012	Chiselled 1 - 1.5m
B-8	20.00	RO	548405.10	418157.00	26.75	5/23/2012	5/24/2012	Chiselled 1 - 1.5m
B-9	20.00	RO	548444.70	418211.20	30.58	5/24/2012	5/25/2012	Chiselled 1 - 1.5m
B-10	14.07	SCP	548361.40	418147.50	24.56	5/25/2012	5/26/2012	Hole located 15m north of railroad
B-11	4.00	TP	548461.90	418182.00	37.65	5/26/2012	5/27/2012	
B-12	14.60	CP+RC	548452.10	418161.70	27.34	5/27/2012	5/28/2012	Cable snapped between 14.00 -
B-13	3.80	TP	548406.80	418093.70	20.78	5/28/2012	5/29/2012	Trial pit formed through old railway
B-14	14.10	RO	548344.90	418196.30	37.60	5/16/2012	5/17/2012	NW corner of tank farm lot
B-15	14.10	SCP	548447.20	418203.20	38.25	5/17/2012	5/18/2012	
B-16	7.50	DCP	548425.00	418088.00	10.89	5/18/2012	5/19/2012	Hole located 15m north of railroad
B-17	9.50	RC	548369.00	418102.90	16.23	5/19/2012	5/20/2012	
B-18	20.00	RO	548385.70	418097.40	9.87	5/20/2012	5/21/2012	Chiselled 1 - 1.5m
B-19	20.00	RO	548415.40	418110.20	16.52	5/21/2012	5/22/2012	Chiselled 1 - 1.5m
B-20	20.00	RO	548463.40	418105.10	20.42	5/22/2012	5/23/2012	Chiselled 1 - 1.5m
B-21	20.00	RO	548405.10	418157.00	26.75	5/23/2012	5/24/2012	Chiselled 1 - 1.5m
B-22	20.00	RO	548444.70	418211.20	30.58	5/24/2012	5/25/2012	Chiselled 1 - 1.5m
B-23	14.07	SCP	548361.40	418147.50	24.56	5/25/2012	5/26/2012	Hole located 15m north of railroad
B-24	4.00	TP	548461.90	418182.00	37.65	5/26/2012	5/27/2012	
B-25	14.60	CP+RC	548452.10	418161.70	27.34	5/27/2012	5/28/2012	Cable snapped between 14.00 -
B-26	3.80	TP	548406.80	418093.70	20.78	5/28/2012	5/29/2012	Trial pit formed through old railway
B-27	14.10	RO	548344.90	418196.30	37.60	5/16/2012	5/17/2012	NW corner of tank farm lot
B-28	14.10	SCP	548447.20	418203.20	38.25	5/17/2012	5/18/2012	
B-29	7.50	DCP	548425.00	418088.00	10.89	5/18/2012	5/19/2012	Hole located 15m north of railroad
B-30	9.50	RC	548369.00	418102.90	16.23	5/19/2012	5/20/2012	
B-31	20.00	RO	548385.70	418097.40	9.87	5/20/2012	5/21/2012	Chiselled 1 - 1.5m
B-32	20.00	RO	548415.40	418110.20	16.52	5/21/2012	5/22/2012	Chiselled 1 - 1.5m

Name=LOCA_LREF. New Row 53

gINT - Examples

INPUT - y:\projects\environmental solutions\events\20120625 diggs\images for marc\gint std ags 4_0.gpj GEOL table Library: g:\gint custom works\special apps\

File Enterprise Additional Modules Edit Format Tools Tables gINT Rules Navigation Help

8-12

INPUT OUTPUT DATA DESIGN REPORT DESIGN SYMBOL DESIGN DRAWINGS UTILITIES

Show tabs [Geology group] Table Help

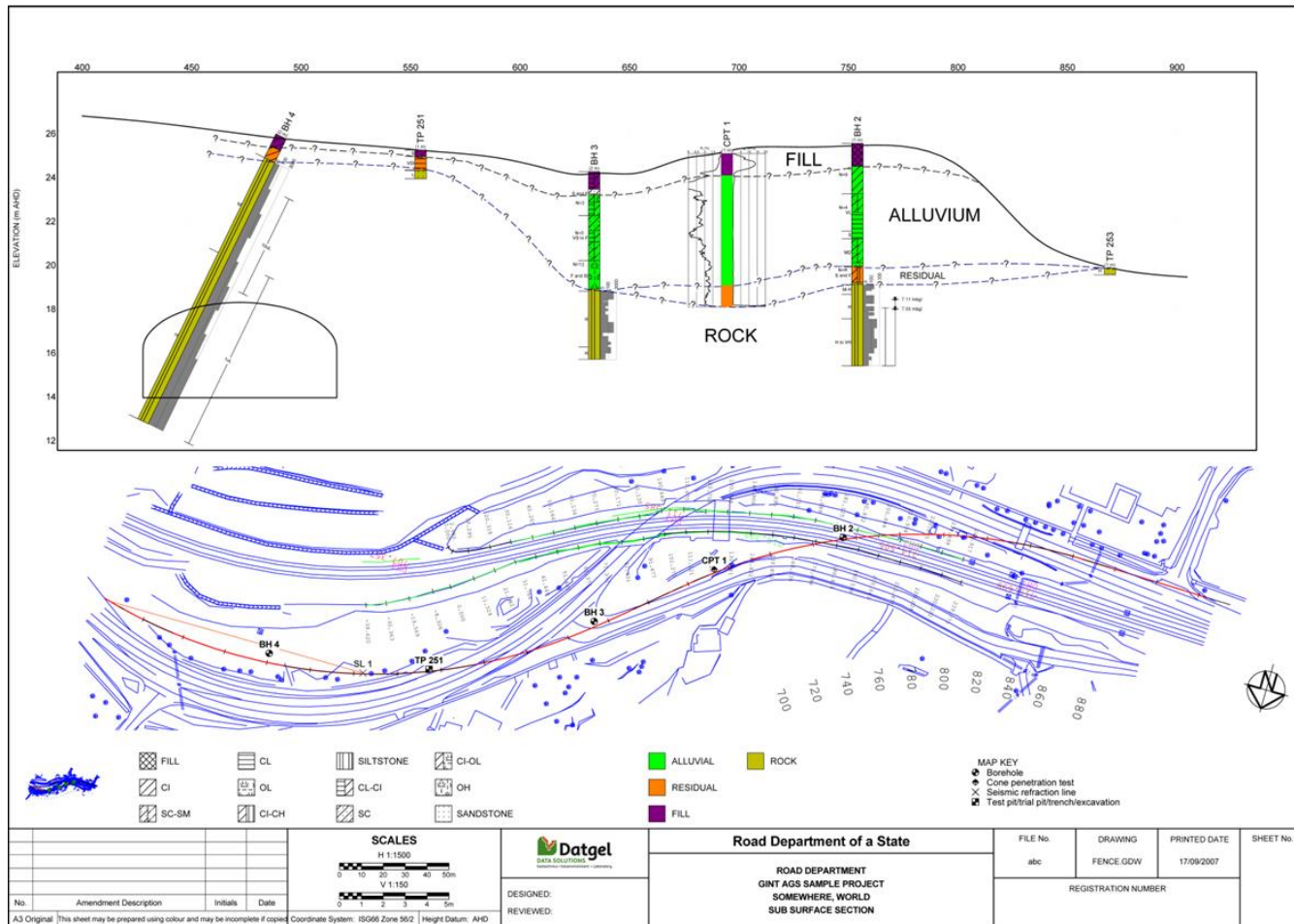
Top depth (m)	Base depth (m)	Legend	Description	Geology code	Geology code 2	Stratum Reference	Graphic
0.00	0.90	SAND	Loose dark brown sandy fine to medium SAND with some rootlets (TOPSOIL)	T			
0.90	3.50	CLAY si	Stiff brown with blue veining silty to sandy CLAY with some fine to medium sub-rounded gravel of mixed lithology	G			
3.50	5.50	CLAY si	Stiff brown silty CLAY with some fine to medium sub-rounded gravel and coal fragments, locally a firm, grey silty clay and brown silty fine	G			
5.50	5.90	SAND si	Firm silty CLAY interlaminated with brown silty sandy clay (locally a clayey sand) with some predominantly fine to medium chalk with	G			
5.90	7.00	CLAY si	Dense brown clayey fine SAND locally a firm brown sandy clay, with some fine to coarse sub-rounded to sub-angular gravel of flint and	G			
7.00	9.70	MUDSTONE	Weak medium bedded red fine silty MUDSTONE (MERCIA MUDSTONE III)	MMG			
9.70	10.80	MUDSTONE	Moderately weak thinly laminated red fine silty MUDSTONE slightly weathered (MERCIA MUDSTONE II)	MMG			
10.80	14.60	SILTSTONE	Moderately strong medium interlaminated red fine silty MUDSTONE and SILTSTONE, slightly weathered (MERCIA MUDSTONE II)	MMG			
*							

Name=Depth. GEOL_TOP Row 1 of 8

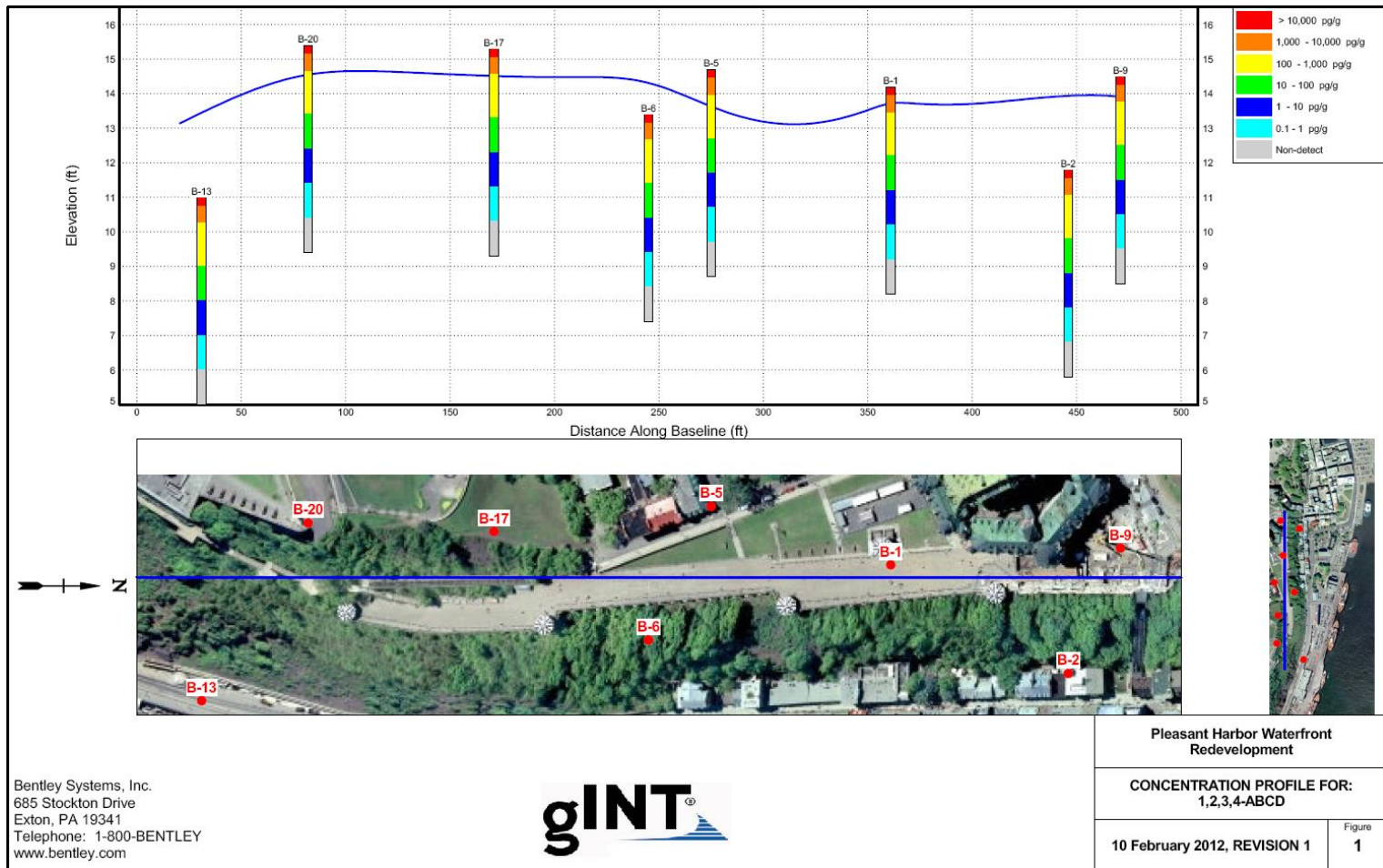
gINT - Examples

gINT										MAPA DEL SITIO		SONDEO Nº S-1		HOJA 1 de 2					
CLIENTE: Mendiberria CÓDIGO: 1234-ABC PROYECTO: Centro Comercial de Pacharan OBSERVACIONES:												LOCALIZACIÓN: Donostia (Gipuzkoa) FECHA COMIENZO: 13-08-08 FECHA FINAL: 14-08-08 DIÁMETRO de PERFORACIÓN: 101 mm MÉTODO de PERFORACIÓN: Perforación continua ORIENTACIÓN: Vertical COORDENADAS: X: 907.7 m Y: 1.600.6 m Z: 37.6 m SONDISTA: Hermanos S.A. REGISTRADO POR: Aritz Aranburu PROFUNDIDAD TOTAL: 14.10 m							
PROFUNDIDAD (m)	LEYENDA	USGS	RECUPERACIÓN (%)	MUESTRA	MUESTRA TIPO Y NÚMERO	GOUGEOS (VALOR N)	R.C.S. (kg/cm²)	% FNDOS	LÍMITE LÍQUIDO	LÍMITE PLÁSTICO	ÍNDICE PLÁSTICO	HUMEDAD NATURAL %	DENSIDAD SECA (g/cm³)	ENSAYO VANE (g/cm²)	PENETRÓMETRO (de BOLSILLO (kg/cm²))	NIVEL FREÁTICO	DESCRIPCIÓN	REGISTRO FOTOGRÁFICO	COTA (m)
0.00																	0.00m TIERRA VEGETAL.		36.00
0.35																	0.35m COLUVIAL LIMO MARRÓN CON ALGO DE GRAVA Y ALGO DE ARENA. MODERADAMENTE FIRME.		36.00
0.36																	- Aparecen yesos en nódulos y diseminados de tonos grises, rosados y verdosos.		36.00
2.05																	2.05m 3.40m COLUVIAL ARCILLA MARRÓN FIRME Y ARCILLA GRIS VERDOSA FIRME. EN INTERCALACIONES DE ESPESOR MILIMÉTRICO Y CENTIMÉTRICO.		34.00
2.05																	- A partir de 3.80m aparecen gravas en indicios y algo de arena de color marrón y gris.		34.00
1.80																	4.20m COLUVIAL ARCILLA MARRÓN VERDOSA CON ALGO DE GRAVA Y ALGO DE ARENA. MODERADAMENTE FIRME A FIRME.		32.00
1.80																	- A 4.80m el color pasa a gris verdoso con tonalidades marrones.		32.00
1.40																	5.60m COLUVIAL ARCILLA MARRÓN FIRME.		30.00
1.40																	- Presenta tonos ocre.		30.00
1.40																	- A partir de 5.75m aparece arena en indicios y mineralizaciones de yesos.		30.00
0.80																	6.40m COLUVIAL LIMO AZUL-VERDOSO CON ALGO DE GRAVA Y ALGO DE ARENA. MODERADAMENTE FIRME A FIRME.		30.00
0.15																	6.50m 6.50m COLUVIAL LIMO ARCILLOSO CON TONALIDADES VERDES, MARRONES Y AZULADAS. MODERADAMENTE FIRME A FIRME.		30.00
0.15																	6.70m COLUVIAL ARENA VERDE AZULADA CON BASTANTE GRAVA E INDICIOS DE LIMO. DENSA.		30.00
0.75																	7.45m COLUVIAL ARENA MARRÓN CON BASTANTE GRAVA E INDICIOS DE LIMO MILIMÉTRICO. MUY DENSO.		30.00
LEYENDA: TURBA ML CL SP										MUESTRA: Muestra Inalterada Muestra Alterada Ensayo de Penetración Standard									

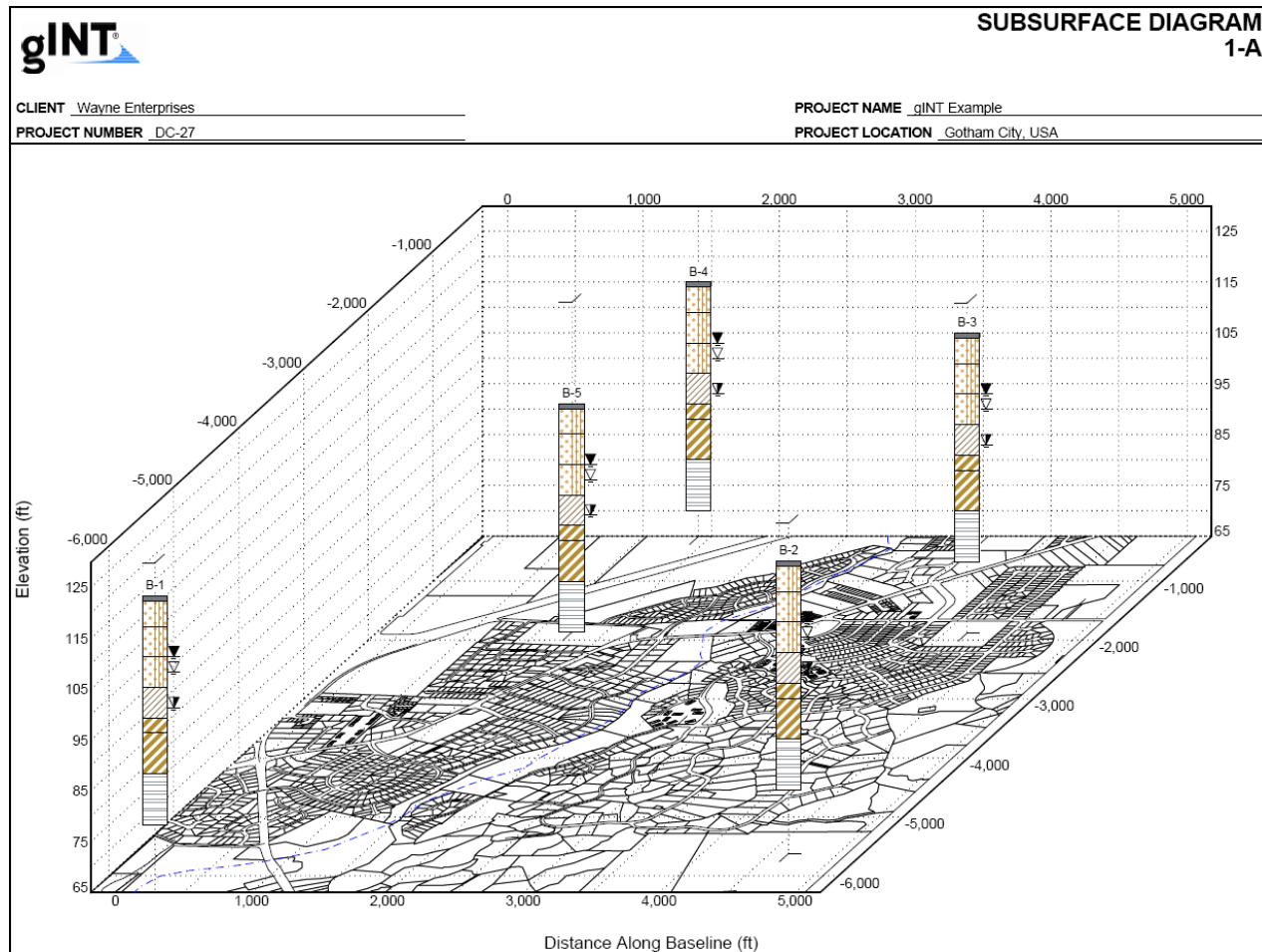
gINT - Examples



gINT - Examples



gINT - Examples



HoleBASE – Geotechnical Data Management

- ❑ Data management and borehole logging software package for geotechnical and geoenvironmental site investigations
- ❑ Capabilities include:
 - Borehole logging
 - Draw cross sections
 - Complete bill of quantities
 - Invoices
 - AutoCAD drawings

Holebase

HoleBASE 3.1 - Current User: System Manager (Project:DLR230991: Quinley Gasworks Rev 4) at c:\programdata\Keynetix\HoleBASE\HoleBASE 3.1\Projects\DLR230991\

File Child Tables Project Reports Graphics Utilities Security System Help

Pick Object or Window First Corner X:399587 Y:301034 50 710 m

Exploratory Hole Information

Hole ID: **BH134** Pan Release Status: **Released**

Type: **CP+RC** Browser Location Trialpit Misc

Depth: **52.700**

Inclination: **-** From Horizontal o From North

Direction: **-**

Start Date: **29/09/1991**

Stop Date: **01/10/1991**

Backfilled: **-**

Documents... Graphing Symbols...

Updated: **07/12/2011 06:47:51**

By: **quinley1:27/06/2008**

Edit New Find... Done Delete

Hole ID	Type	Depth
BHDEMO	CP	25.500
CPT1	SCP	10.000
BH1	CP	10.000
BH2	CP	9.800
BH127	CP	12.500
BH128	CP	11.750
BH129	CP	21.950
BH130	CP	20.000
BH134	CP+RC	52.700
BH135	CP	30.150
BH136	CP	10.050
BH137	CP	10.050
BH138	CP	10.050
BH139	CP	6.1
BH140	CP	5.0
BH141	CP	5.5
BH142	CP	5.5
BH143	CP	5.5
CP1	DP	5.0
TP121	TP	4.3
TP122	TP	4.5
TP123	TP	4.3
TP124	TP	4.6
TP125	TP	4.6
TP126	TP	4.5
TP127	TP	4.5
TP128	TP	4.0
TP129	TP	4.5
TP130	TP	4.5
TP131	TP	4.5
TP132	TP	4.3
TP159	TP	4.4

Statistics

CP: **14**

CP+RC: **1**

DP: **1**

SCP: **1**

TP: **13**

Sample Records & Lab Test Results BH134

Top	Ref	Type
26.500	57	U
26.950	58	D
27.700	59	D
28.000	60	D

Top: **28.000** Ref: **60** Type: **D**

Acquisition Data Observations Test Results

Base Depth: **0.000** Diameter: **0**

Remark:

Description:

Rotary Core Data BH134

Top	Base	RQD
43.050	44.500	10.00
44.500	46.500	40.00
46.500	48.500	45.00
48.500	50.500	30.00

Depth: **48.500** Diameter: **0**

Base: **50.500** Length: **2000**

Core Recovery (%)

Total: **50** Solid: **40** RQD: **30**

Remarks:

Documents... Edit New Delete Done

Geology Records for BH134

From	To	Legend	Geology Code
34.500	35.540	803	SANDSTONE
35.540	43.070	803	SANDSTONE
43.070	49.400	803	SANDSTONE
49.400	52.700	811	COARSE GRAINED

Base Depth: **52.700**

Geology Code: **COARSE GRAINED IGNEOUS**

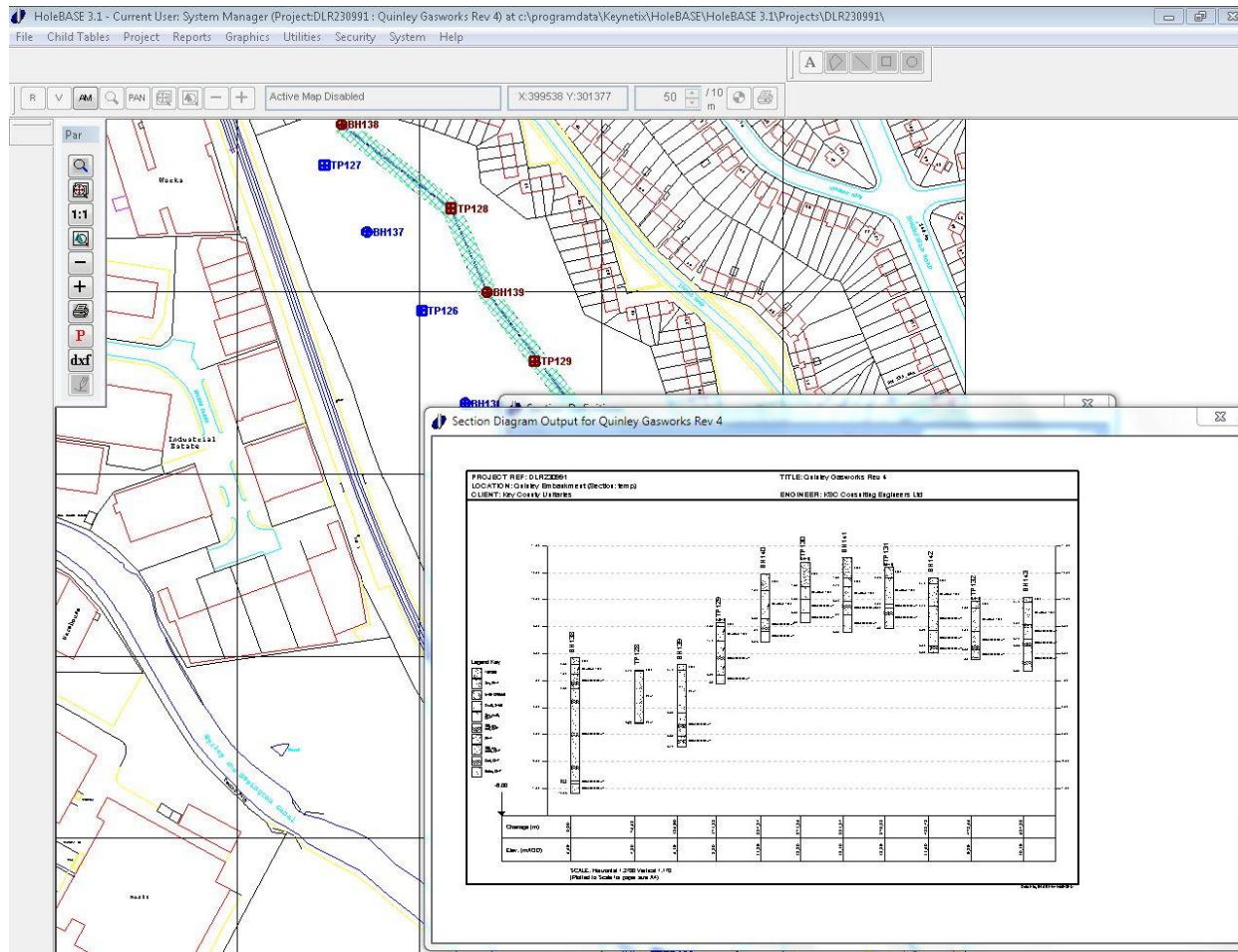
2nd Geol Code:

Legend Code: **811** Stratum Number: **CG**

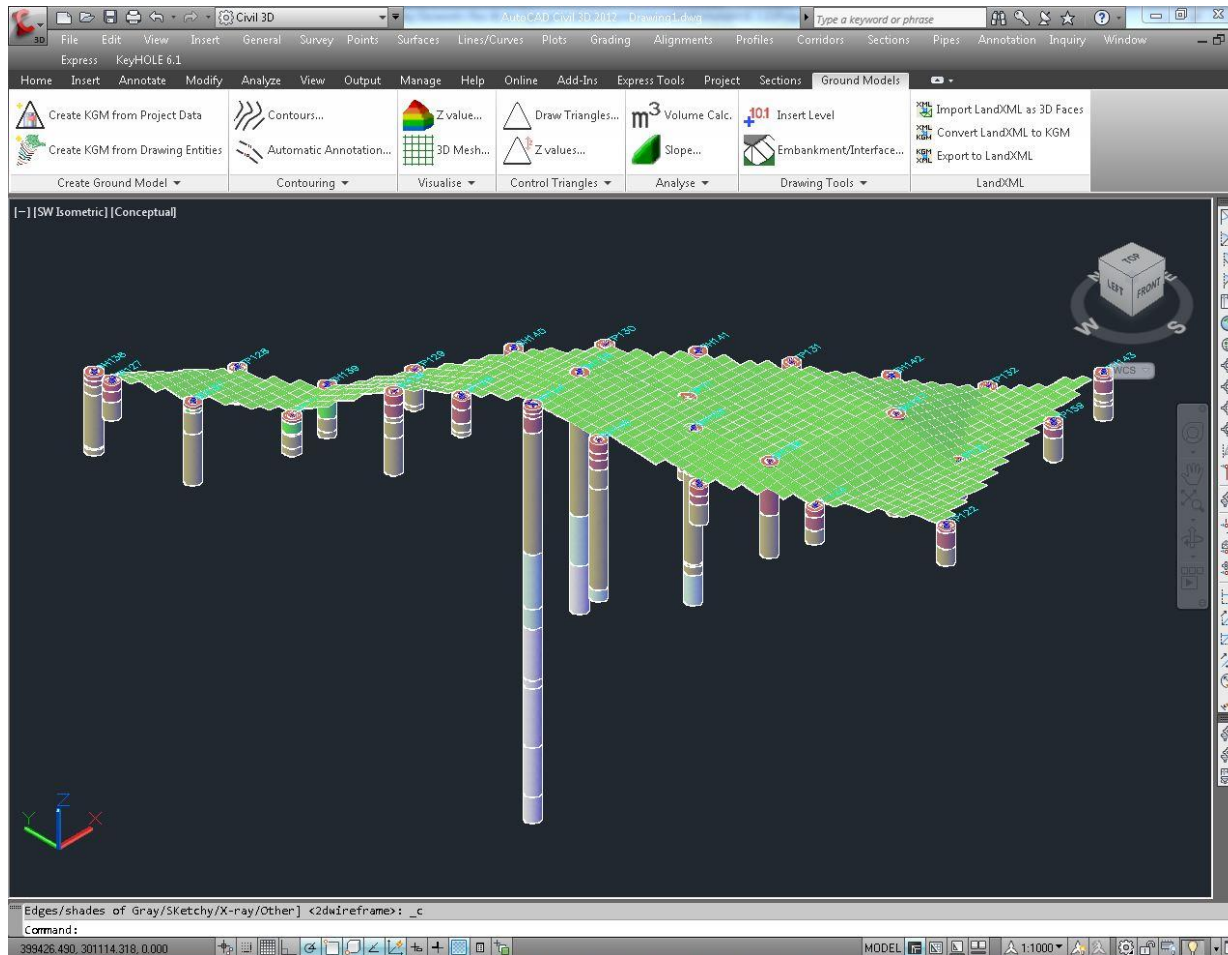
Description: **Coarse grained slightly weathered basaltic lava dyke**

Insert... Documents... Edit Append Delete Done

Holebase



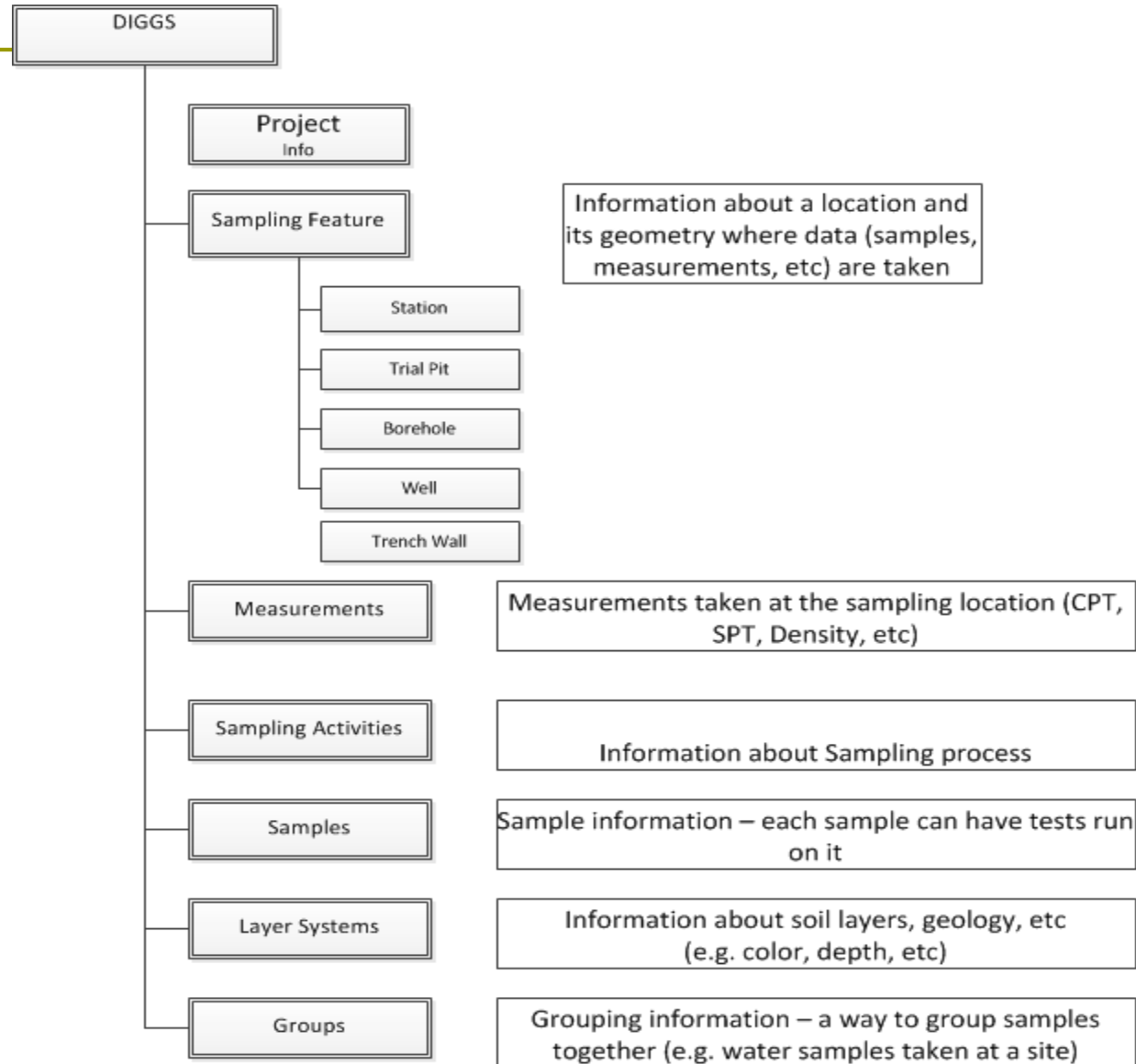
Holebase



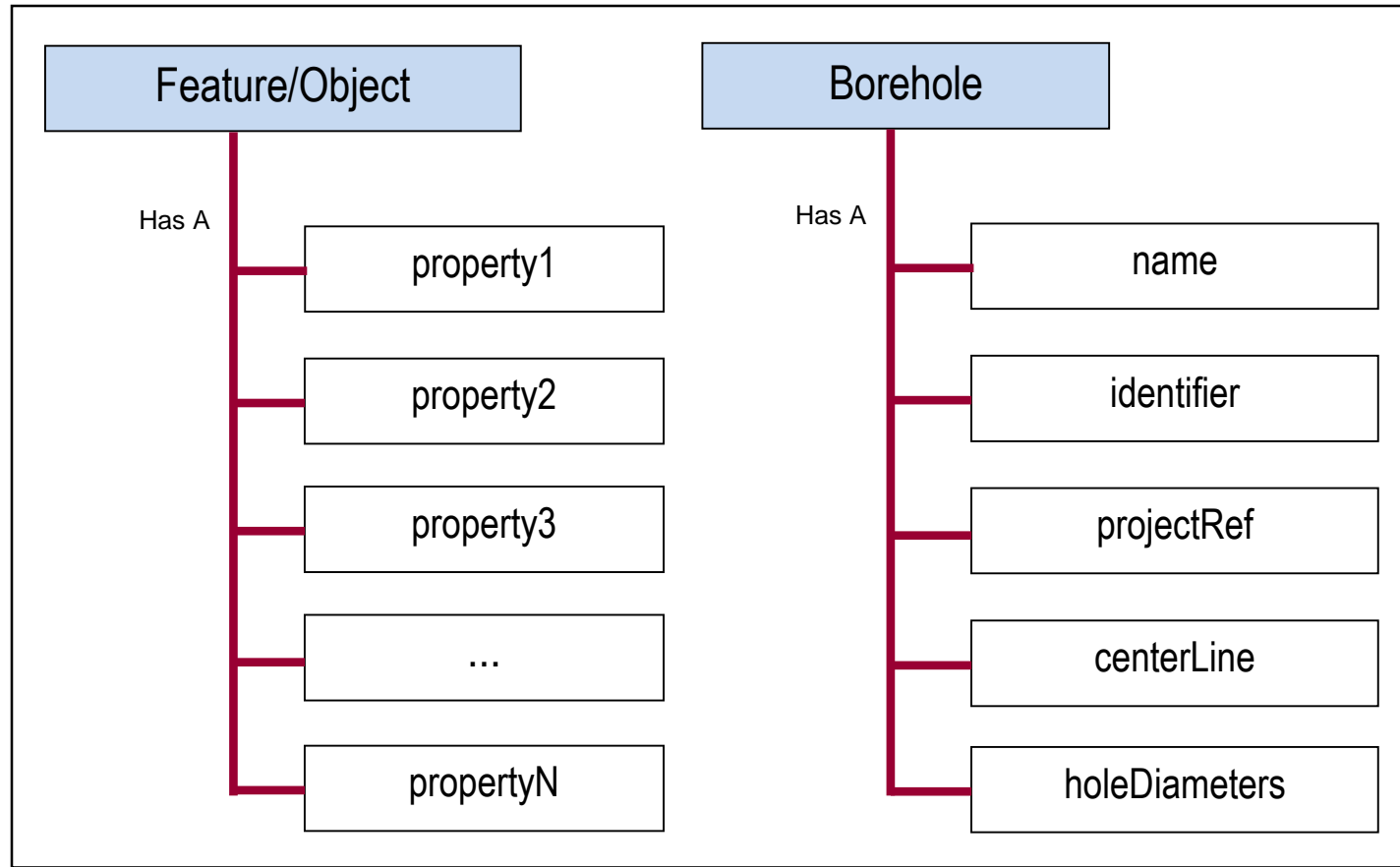
DIGGS Research Results

- Project deliverables consist of:
 - Final data dictionary (imbedded in the XML schema)
 - XML schema including:
 - Boreholes, soil layers, tests & measurements, samples, wells, logging, code lists
 - A guideline for using and adding to the schema
 - Tools supporting the schema:
 - MS Excel extractor
 - Google KML converter tool

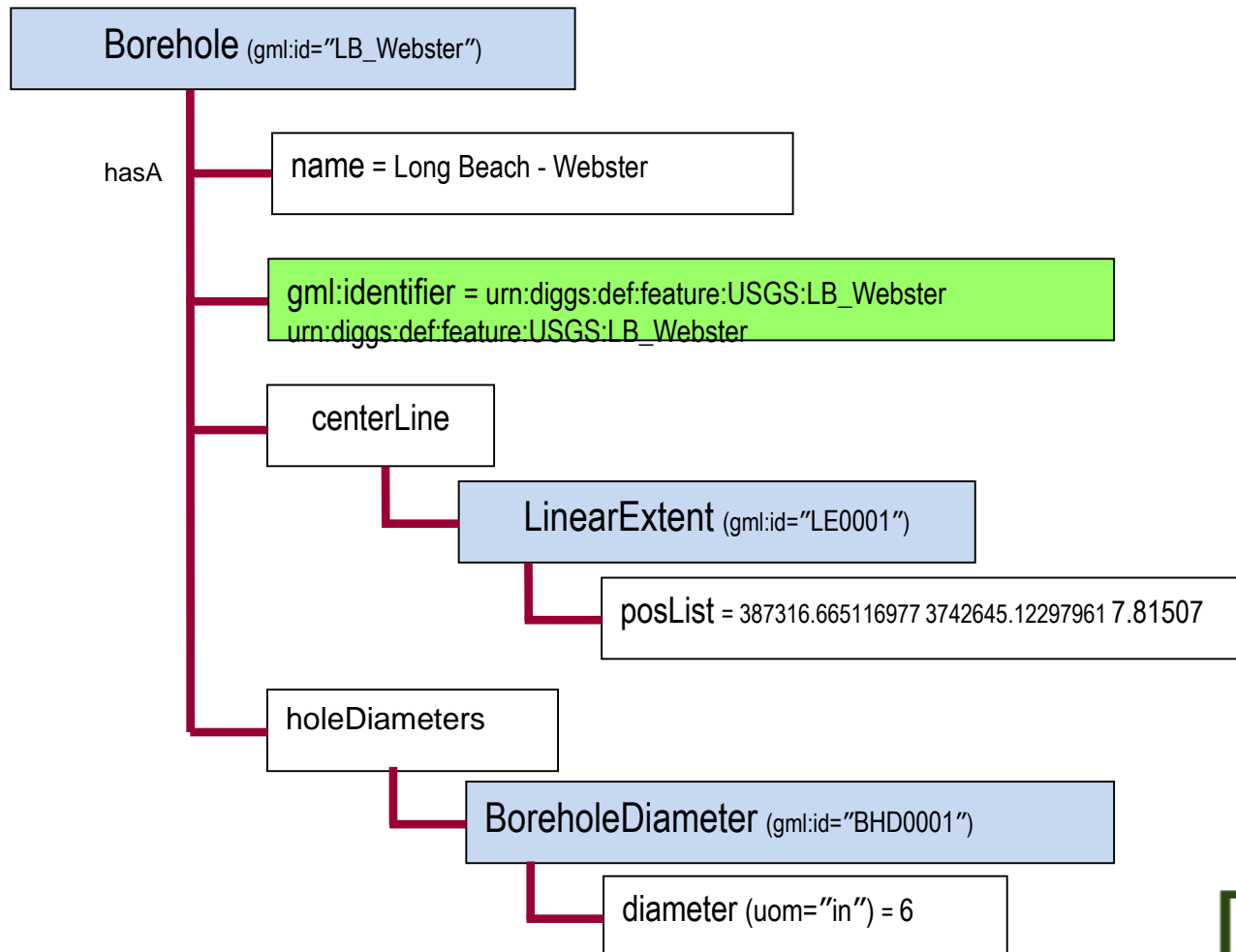
Basic Schema Layout



GML - Feature



DIGGS – Borehole Feature



Example XML Excerpt

<Borehole gml:id="LB_Webster">

<gml:name>Long Beach - Webster</gml:name>

<gml:identifier>urn:diggs:def:feature:USGS:LB_Webster
</gml:identifier>

...

<centerLine>

<**LinearExtent** srsName="urn:diggs:def:crs:DIGGS:
26911_5703" srsDimension="3" gml:id="LS0001">

<gml:posList>387316.665116977 3742645.12297961
7.81507 387316.665116977 3742645.12297961 -
420.124129847717</gml:posList>

</**LinearExtent**>

</centerLine>

...

<holeDiameters>

<**BoreholeDiameter** gml:id="bhd1">

<diameter uom="in">6</diameter>

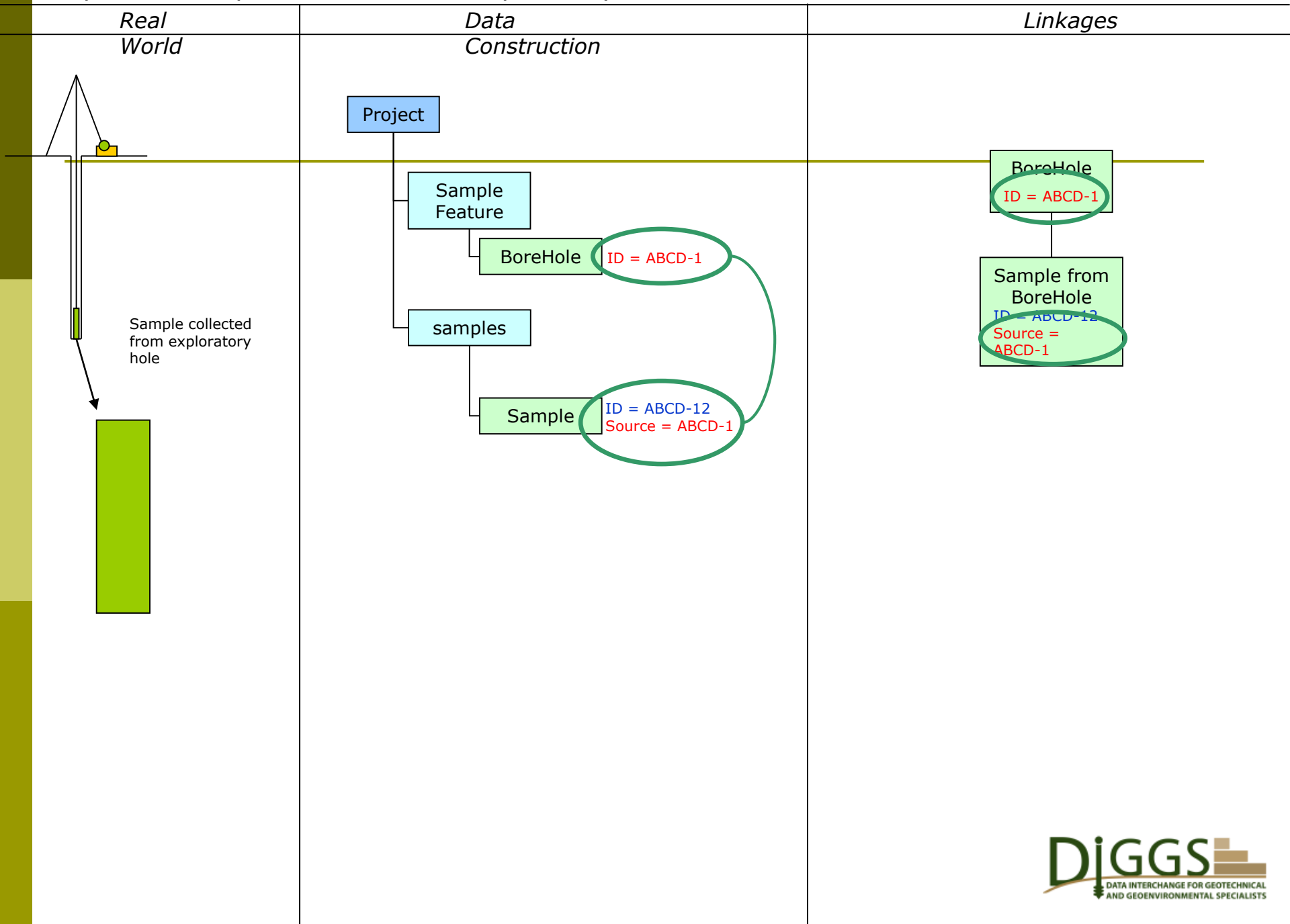
</**BoreholeDiameter**>

</holeDiameters>

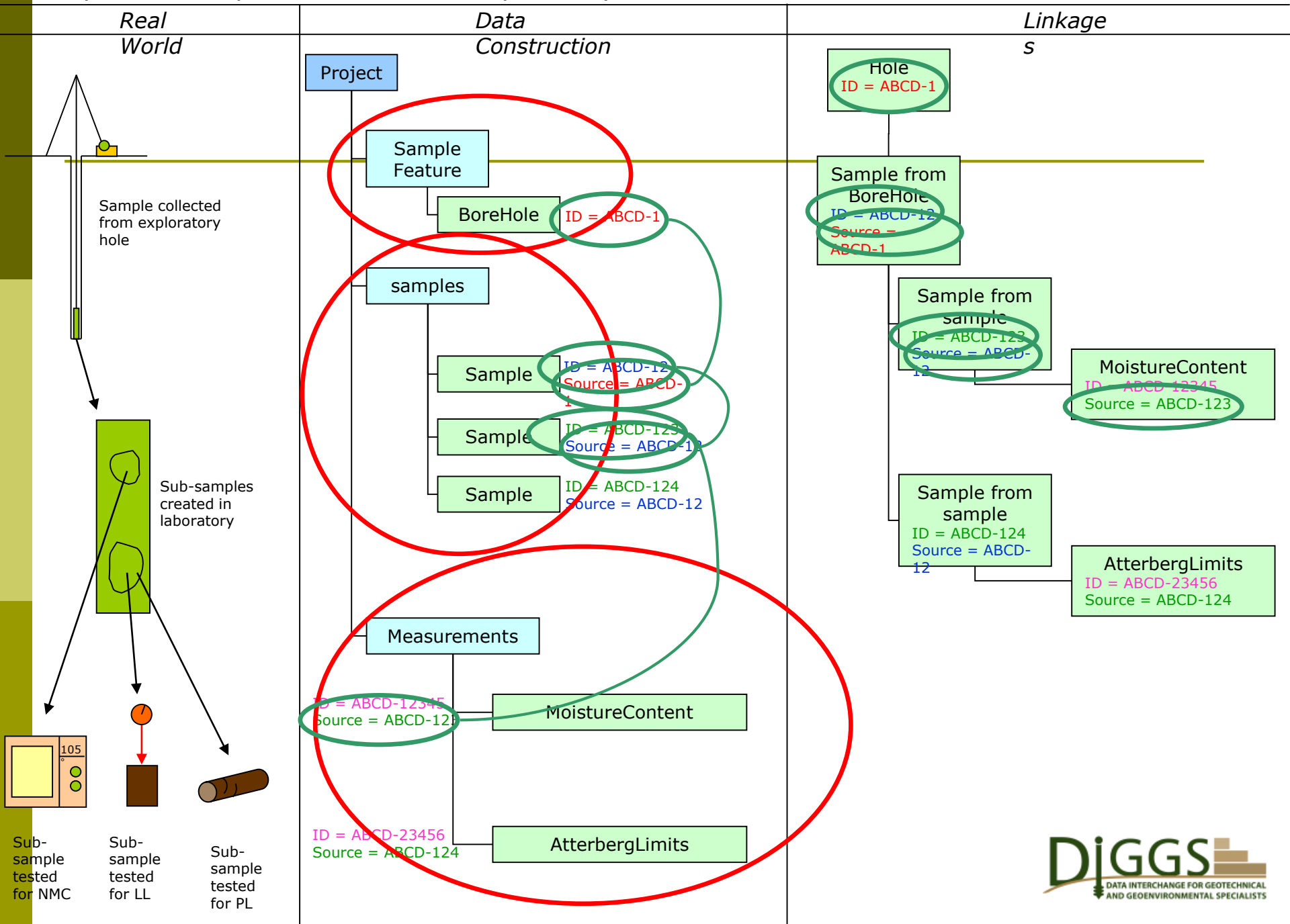
...

</Borehole>

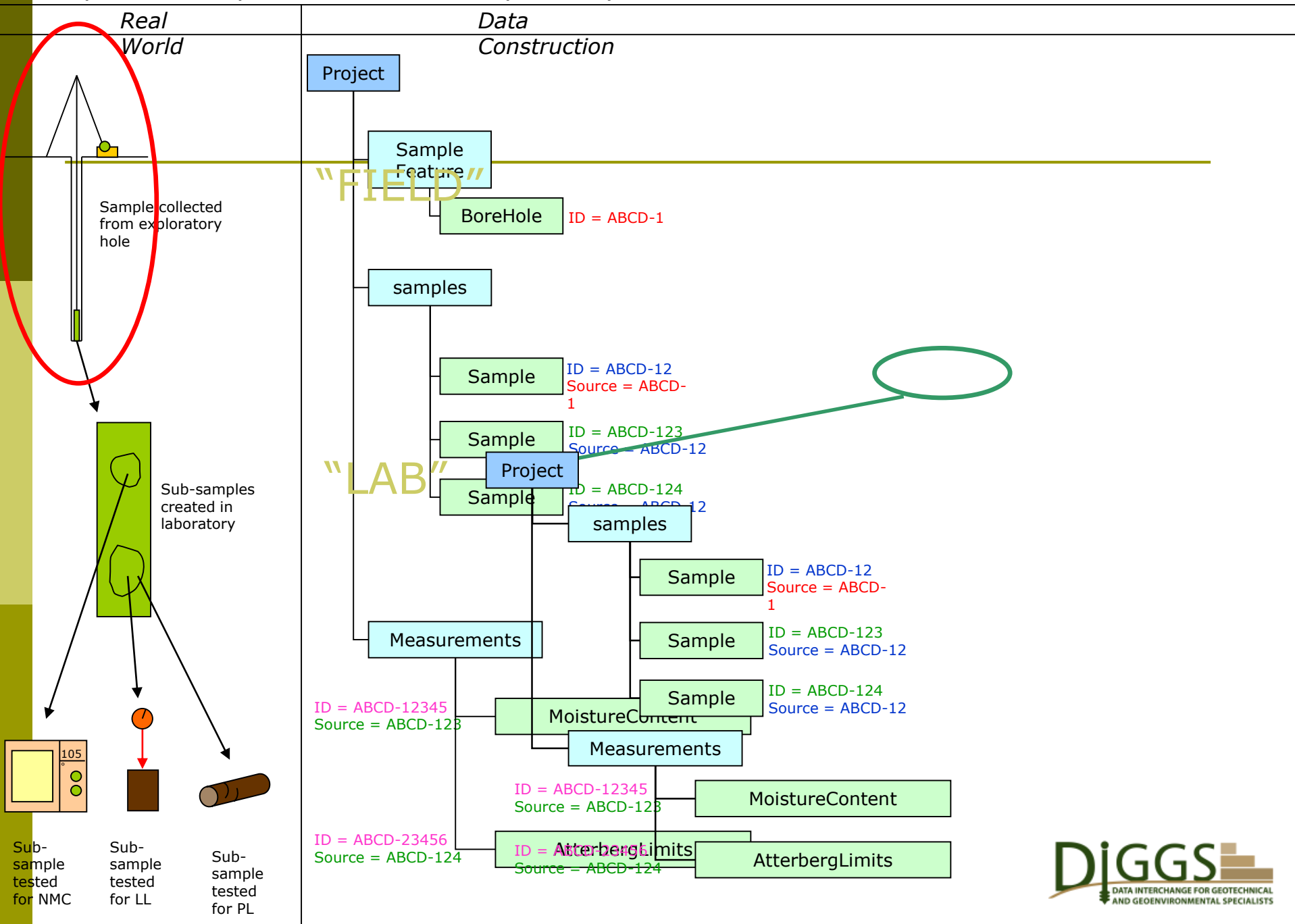
Example 1 – Sample Taken from an Exploratory Hole



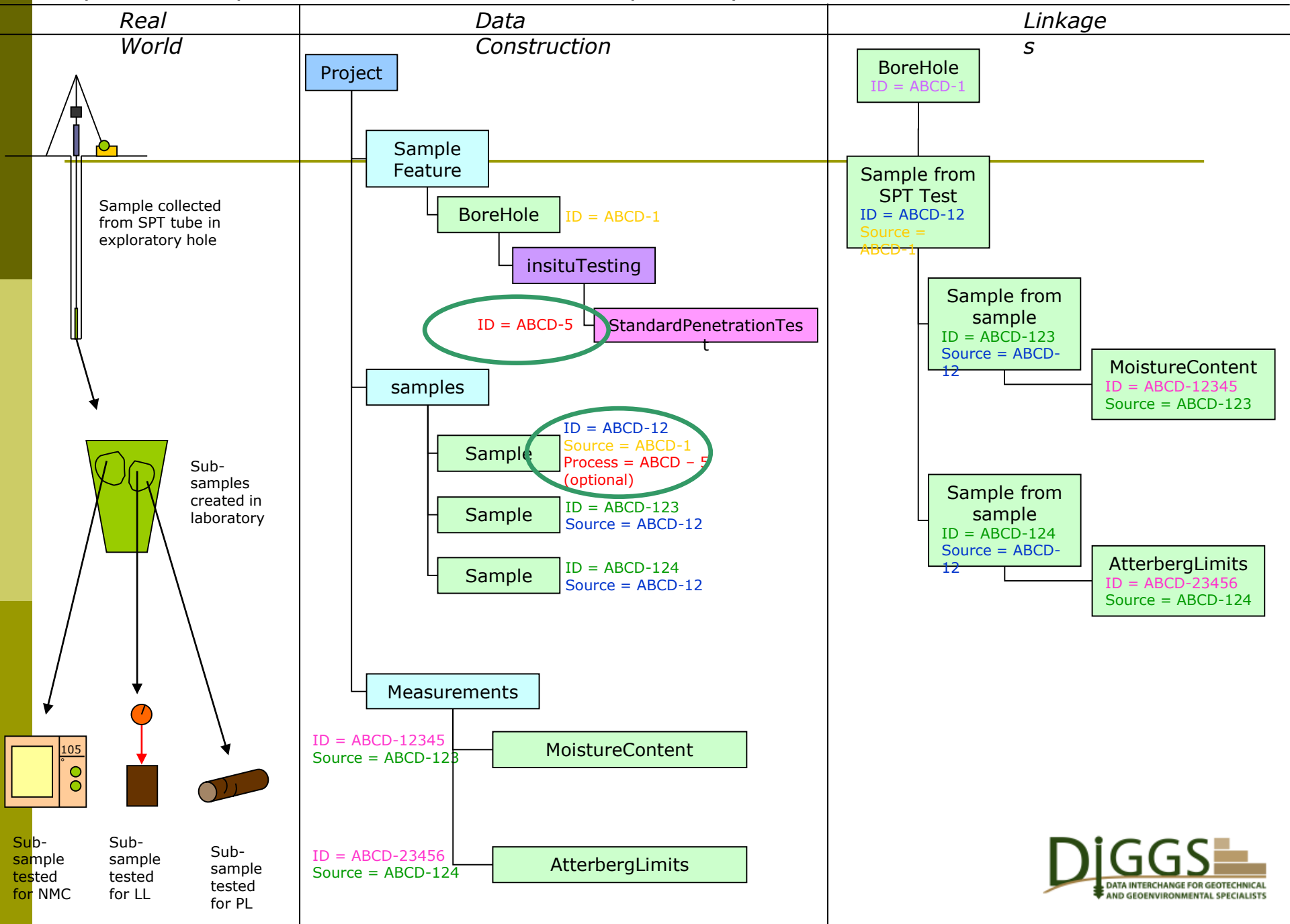
Example 2 – Sample Taken from an Exploratory Hole, tested for NMC, LL and PL



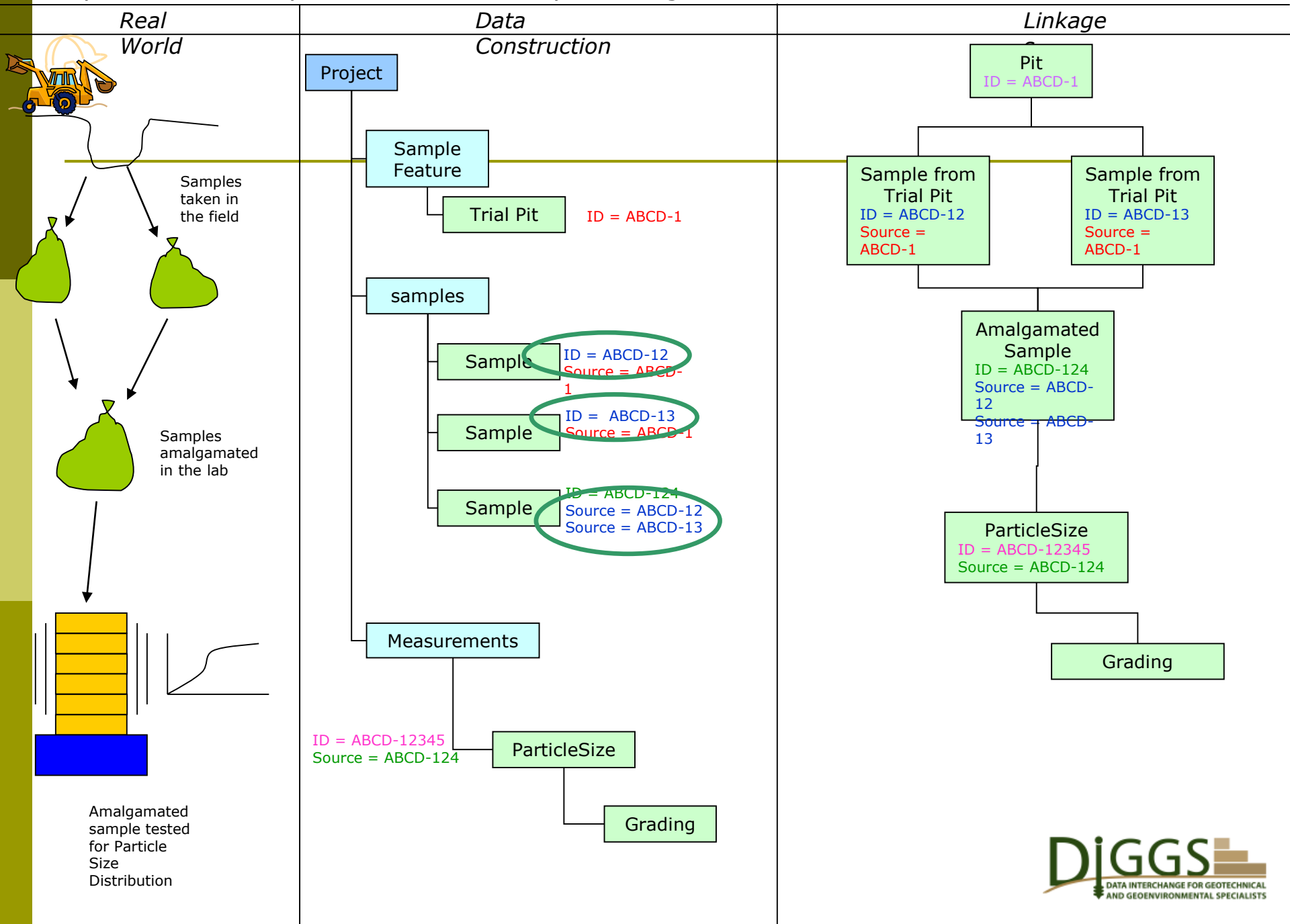
Example 2 – Sample Taken from an Exploratory Hole, tested for NMC, LL and PL



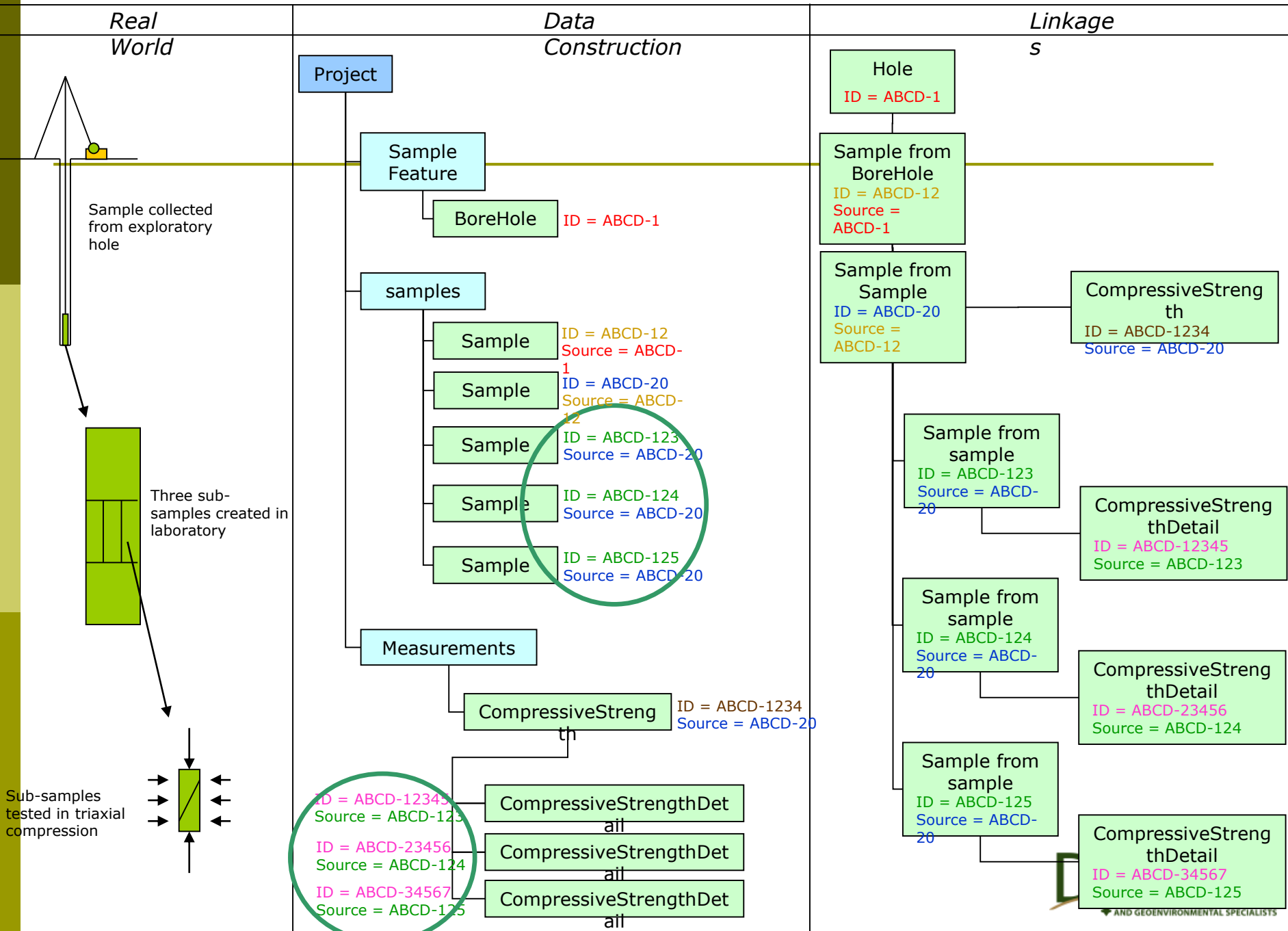
Example 3 – Sample Taken from an SPT in an Exploratory Hole, tested for NMC, LL and PL



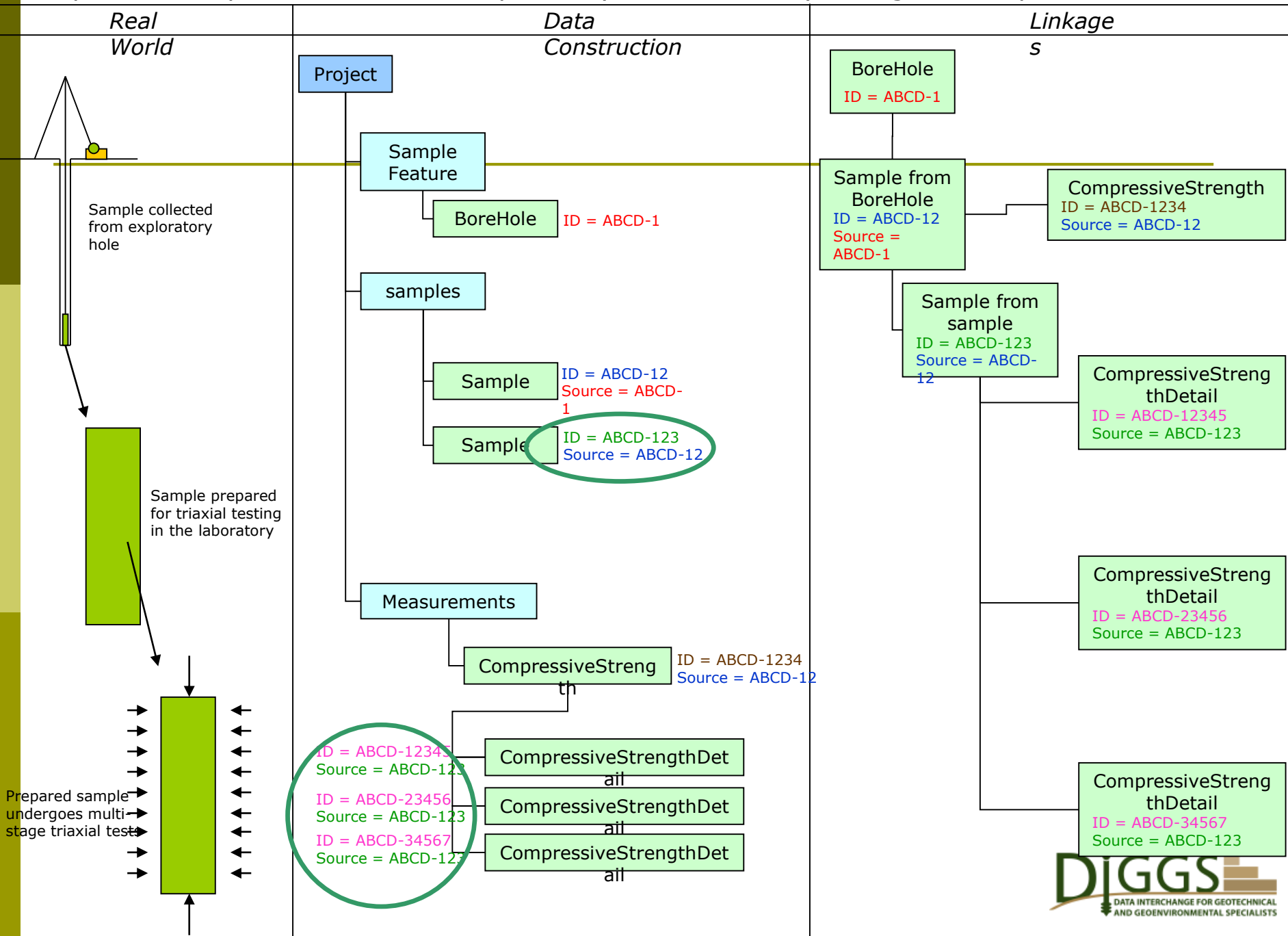
Example 4 – Two samples taken from trial pit, amalgamated and tested for PSD



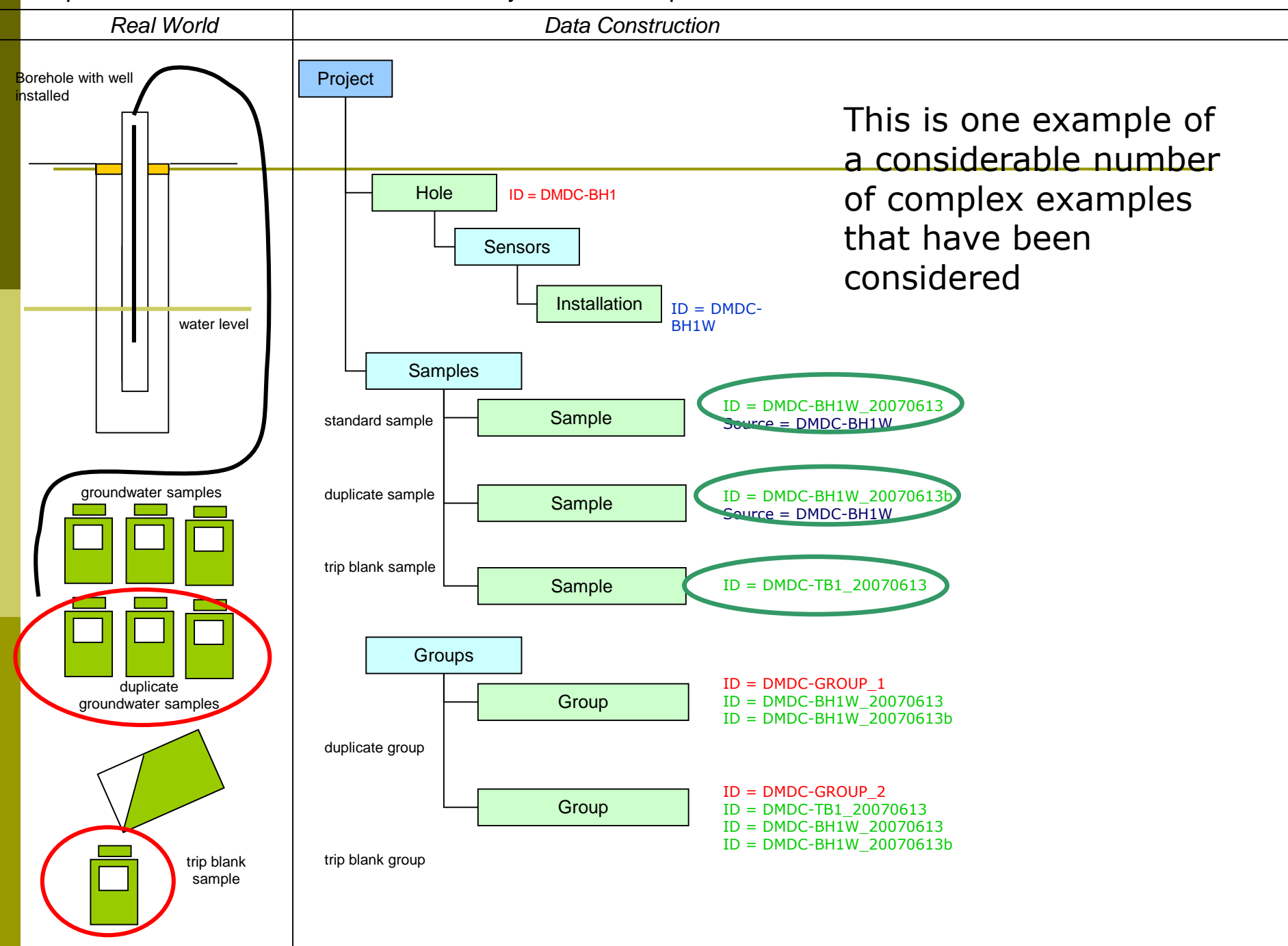
Example 5 – Sample Taken from an Exploratory Hole, tested by 3 stage, 3 sample triaxial test



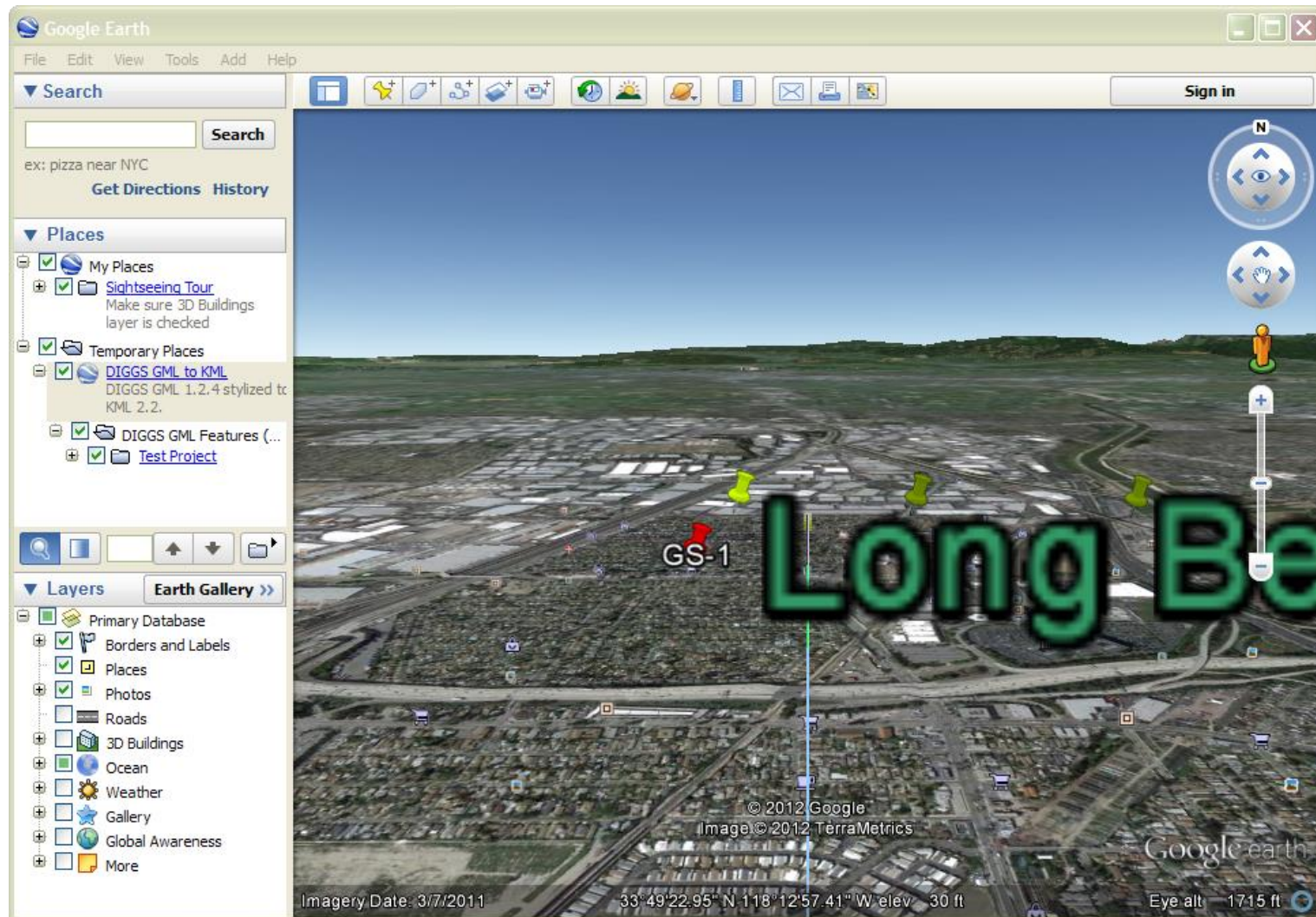
Example 6 – Sample Taken from an Exploratory Hole, tested by 3 stage, 1 sample triaxial test



Example 7 – Geoenvironmental: Field Quality Control Samples



DIGGS – KML (Google) Viewer



DIGGS to Excel Converter

DiggsToExcel_v6.xls [Compatibility Mode] - Microsoft Excel

Home Insert Page Layout Formulas Data Review View Developer Add-Ins Acrobat

Clipboard Font Alignment Number Styles Cells Editing

Security Warning Some active content has been disabled. Options...

A1

DIGGS
DATA INTERCHANGE FOR GEOTECHNICAL
AND GEOENVIRONMENTAL SPECIALISTS

DIGGS to Excel Conversion

Instructions

(1) Click the *Load DIGGS File* button

(2) Select a DIGGS GML instance and click *Open* (it may take a few seconds to load the file, depending on its size/complexity)

(3) View each feature/object type from the DIGGS file in a separate Excel worksheet (optionally use *Ctrl + PgUp/PgDn* to cycle through worksheets faster)

(4) Optionally, click the *Clear Spreadsheet* button to clear the loaded data

Note that this spreadsheet works for DIGGS GML version 1.2. For more information on the DIGGS data model see <http://www.diggsml.com/>.

Load DIGGS File **Clear Spreadsheet**

Welcome DIGGS Configuration

Ready 100%

FOR GEOTECHNICAL
AND GEOENVIRONMENTAL SPECIALISTS

Excel – Tabbed Structure for Data

A			B		C				
1	Home Page		Previous Page		Next Page				
2									
3	Property Name		Attribute Name		Property Value				
4	Project		ID:		p1				
5	Name				Test Project				
6	Remarks								
7	Remark								
8	Content				This could be a virtual project that has no relevance				
9	Associated Location Ref				#LB_Webster				
10	Associated Location Ref				#a22				
11	Associated Location Ref				#cpt-1				
12	Sampling Activity Ref				#zyx				
13	Group Ref				#g1				
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									

C		D	E	F
Next Page				
Property Value				
bcd				
#d1				
#p1				
#LB_Webster				
#a22				
#cpt-1				
#d123				
#d1e242				
#gl1				
#xyz				
#zyx				
#pointSample				
#s321				
#s123				
#sampt				
#ls-1				
#ls2				
#lst1				
#fs1				
#lst usc				

Project	Borehole	Point	LineString	LinearSpatialReferenceSystem	Linea
14 Sampling Activity					
15 Sampling Activity					
16 Sample					
17 Sample					
18 Sample					
19 Layer System					
20 Layer System					
21 Layer System					
22 Layer System					
23 Layer System					

Diggs	DocumentInformation	SoftwareApplication	Project	Borehole	Poi
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CPT Data Extract

	A	B	C	D	E	F	
1	Home Page	Previous Page	Next Page				
2							
3	Property Name	Attribute Name	Property Value				
4	Log	ID:	MPC001				
5			<u>Log position (#cptsr1)</u>	<u>Tip Resistance (kN/m2)</u>	<u>Sleeve Resistance (kN/m2)</u>	<u>Friction Ratio</u>	<u>Pore V</u>
6			0.010	0.1300	0.40	0.0000	0.0013
7			0.020	0.2400	0.40	0.1000	0.0078
8			0.030	0.5500	0.40	0.0040	0.0126
9			0.040	0.6800	0.40	0.0070	-0.0017
10			0.050	0.7800	0.30	0.0120	-0.0121
11			0.060	0.9000	0.30	0.0150	-0.0161
12			0.070	0.9600	0.40	0.0200	0.0191
13			0.080	1.0400	0.40	0.0240	-0.0120
14			0.090	1.0700	0.30	0.0270	-0.0129
15			0.100	1.1000	0.30	0.1000	-0.0123
16			0.110	1.1300	0.40	0.0350	-0.0176
17			0.120	1.1800	0.30	0.0400	-0.0234
18			0.130	1.2400	0.40	0.0430	-0.0206
19			0.140	1.2600	0.40	0.0460	-0.0277
20			0.150	1.2600	0.40	0.0480	-0.0303
21			0.160	1.2800	0.40	0.0490	-0.0413
22			0.170	1.2900	0.40	0.0500	-0.0482
23			0.180	1.2600	0.30	0.0500	-0.0455

<http://diggsml.org> — Website



International geotechnical and geoenvironmental data interchange framework based on XML and GML.
Written by geotechnical professionals, for geotechnical professionals.

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Data Interchange for Geotechnical and GeoEnvironmental Specialists (DIGGS)

DIGGS is a coalition of government agencies, universities and industry partners whose focus is on the creation and maintenance of an international data transfer standard for transportation related data. The coalition came into existence through coordination from the US Federal Highway Administration sponsoring meetings and eventually forming the pooled fund study project. The initial base schema consists of geotechnical data including Borehole, soil testing, site information and more. The first SIG is extending the schema to include Geo-Environmental testing. More SIGs and expanded membership are in the works.

The draft DIGGS standard is available for review and comment. In order to act as a reviewer, you must [create an account](#). You will then have access to [download the schema and documentation](#) as well as participate in the [online discussion forum](#). The forums will be monitored and the DIGGS team will answer questions to help in the understanding and implementation of the schema and will be the main point of contact for review comments. The schema will be updated monthly with corrections and additions during the review. [Review Forum >](#)

Recent Blog Entries ([Full Blog Listing](#))

Status of Work on the DIGGS v1.2 Release

September 4, 2010 - 1:13am — [LTurner](#)

It's been several months since the release of DIGGS v1.1 this past April. At the roll-out meeting we had anticipated having a version 1.2 ready by July. However, the changes in version 1.2 have required far more analysis and work than originally anticipated. ([Read more....](#))

[LTurner's blog](#) [Read more](#) [3 attachments](#)

[Public](#) [Frontpage](#)

DIGGS v1.1 Release

May 19, 2010 - 10:30pm — [LTurner](#)

We are pleased to announce the release of DIGGS v1.1. This release includes a number of significant schema changes. The net result is a schema that is more robust and easier to use, far less complex in organization and file size, loads and validates much quicker, and is compliant with GML 3.2 standards.

[LTurner's blog](#) [Read more](#) [1 attachment](#)

[Public](#) [Frontpage](#)

Pooled Fund Project TPF 5(111)

The Pooled Fund Project is a US Federal Highways Administration project administered by the state of Ohio. Multiple states commit funds to create a larger project under which all organizations receive the benefit from the project. The DIGGS project was created to develop an international standard interchange format for geotechnical data. The project brought together the existing formats created by Association of Geotechnical and Geoenvironmental Specialists in the United Kingdom (AGS), Consortium of Organizations for Strong-Motion Observation Systems (COSMOS) and Florida Department of Transportation (FDOT) created by the University of Florida (UF). The project has a governance structure for developing the base schema as well as Special Interest Groups (SIG) to create extensions. The result of the project is the DIGGS schema. [Pooled Fund Project >](#)

Lessons Learned

□ **Data Dictionary is the most critical part**

■ Agreement on how to:

- measure a reference point (top or bottom), how to define a collection process, how to assign sample numbers, etc

required a huge investment of time, large number of experts from various countries and disciplines.

- Using a core team of people and concentrated time (workshops) was critical to success

□ **Recommended:** Best practices from AGS involving stakeholders in developing corrections, new additions and releases.

Lessons Learned

- ❑ **Involve a paid industrial partner (GML expert) sooner in the process.**
 - Workshops were excellent format for dictionary & early schema versions.
 - Handled the difficult consensus building with subject matter experts

- ❑ **Recommendation:** when converting to a final schema, schema experts should have been brought in sooner for GML expertise

Recommendations – Future Work

□ **Items not included in the current version**

- Deep Foundations (parts of the UF-FDOT schema)
 - Geotechnical components are covered, deep foundation portions are not.
 - Recommended that SIG formed to include in next release
- Parts of the US-EPA schemas.
 - Many parts can be covered by DIGGS,
 - Recommended that a SIG be created in conjunction with US-EPA and develop the remaining portions.

Future Additions to DIGGS

- ❑ Schematron validation tool
- ❑ Web authoring tool for readable forms
- ❑ Web validator – to check files compliance
- ❑ Data and Map server for detailed mapping
- ❑ Identifier Registry to share specific changes
 - CRS and Units Registry
 - Data/Metadata Registry for businesses, equipment codelists and other data to ensure compatibility

Future of DIGGS

- ❑ ASCE – Geo-Institute will take ownership of DIGGS
 - Treat as new standard (under Codes & Standards Division)
 - Form a committee (with outside members)
 - Maintain:
 - ❑ Schema standard (new form of technical standard)
 - ❑ Website, standard updates, etc
- ❑ Transfer process:
 - Ohio DOT to fund implementation (transfer and startup)

Supporters/Promoters of DIGGS

- ❑ AGS (UK Association of Geotechnical and Geoenvironmental Specialists)
- ❑ Bridge Software Institute, University of Florida
- ❑ CIRIA (UK Construction Industry Research and Information Association)
- ❑ COSMOS (Consortium of Organizations for Strong-Motion Observation Systems)
- ❑ Delta Environmental Consultants, Inc.
- ❑ EarthSoft Inc.
- ❑ Galdos Inc.
- ❑ gINT Software Inc. (Bentley Systems, Inc.)
- ❑ Keynetix Ltd.
- ❑ Mott MacDonald
- ❑ North Carolina State University
- ❑ Petrochemical Open Standards Consortium
- ❑ United States Federal Highways Administration
- ❑ United Kingdom Highways Agency
- ❑ US Departments of Transportation (CA, CT, FL, GA, IN, KS, KY, MN, MO, NC, OH, TN)
- ❑ United States Geological Survey
- ❑ United States Army Corps of Engineers
- ❑ United States Environmental Protection Agency
- ❑ United States Navy
- ❑ University of New Hampshire