HydroCube: an entity-relationship hydrogeological data model
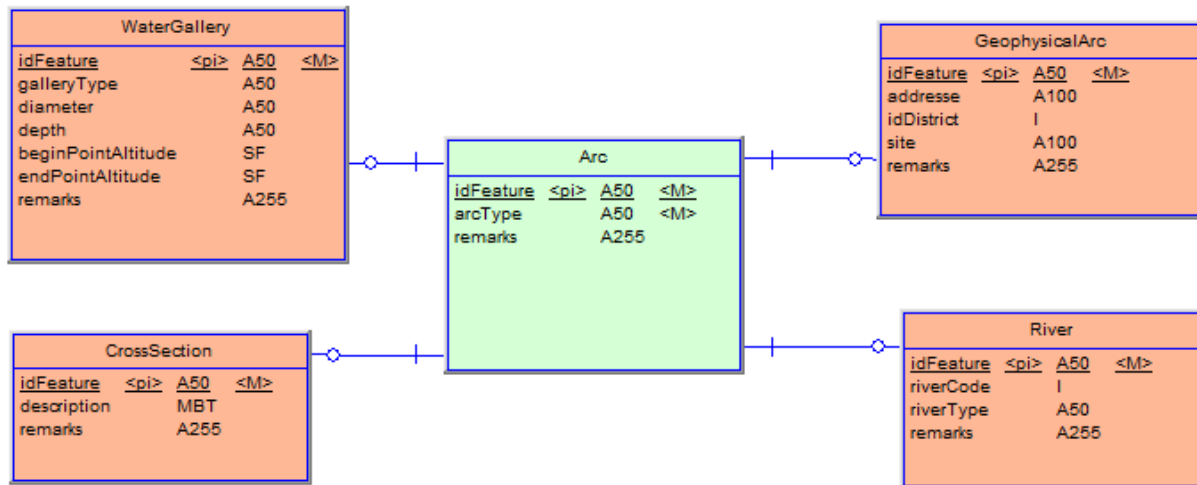
P. Wojda, S. Brouyère, J. Derouane, A. Dassargues

Figure ESM 1. Entity-relationship diagram of linear feature entities. Data types and symbols notation for all the figures: A(x): characters (number); I: Integer (can also be a primary identifier from a dictionary); F: float; SF: short float; DT: date and time; MBT: Multibyte; BL: Boolean; <pi>: primary identifier; <M>: mandatory value. Commas equate to decimal points.

Mine

idFeature	<pi>	A50	<M>
codeWR		A50	
idMap		I	
mineType		A50	
place		A50	
addresse		A60	
idDistrict		I	
exploited		BL	<M>
exhart		BL	<M>
exhnat		BL	<M>
remarks		A255	

HydrologicalBasin

idFeature	<pi>	A50	<M>
basinName		A50	
remarks		A255	

HydrogeologicalBasin

idFeature	<pi>	A50	<M>
basinName		A50	
remarks		A255	

ProtectionZone

idFeature	<pi>	A50	<M>
type		A50	
designMethod		I	
protectionZoneCode		A50	
status		A15	
contactAgent		A50	
decreeDate		DT	
decreeText		MBT	
remarks		A255	

Polygon

idFeature	<pi>	A50	<M>
polygonType		A50	<M>
remarks		A50	

GeophysicalPolygon

idFeature	<pi>	A50	<M>
idMap		I	
idDistrict		I	
remarks		A255	

StudyZone

idFeature	<pi>	A50	<M>
year		I	
commanditaire		A50	
accessRules		A50	
localisation		A255	
studyCode		A50	
studyWebsite		MBT	
remarks		A255	

MathematicalModel

idFeature	<pi>	A50	<M>
modelAim		A100	
remarks		A255	

SurfaceWaterBody

idFeature	<pi>	A50	<M>
type		A50	
code		I	
remarks		A255	

GroundwaterBody

idFeature	<pi>	A50	<M>
type		A50	
code		I	
remarks		A255	

Figure ESM 2. Entity-relationship diagram of polygon feature entities.

Grouting

idEquipement	A50	<M>
topGrouting	SF	
bottomGrouting	SF	
remarks	A100	
idGrouting	<pi> A50	<M>

GravelPack

idEquipement	A50	<M>
sizeGravelPack	A20	
topGravelPack	SF	
bottomGravelPack	SF	
remarks	A100	
idGravelPack	<pi> A50	<M>

Well

idWell	<pi> A50	<M>
wellType	A50	
codeWR	I	
identifierWR	I	
codeSGB	I	
access	BL	<M>
existe	BL	<M>
exploite	BL	<M>
constructionDate	DT	
depth	SF	
remarks	A255	

Equipment

idWell	A50	
topSurfaceCasing	SF	
bottomSurfaceCasing	SF	
diameterSurfaceCasing	SF	
screenedLevels	I	
remarks	A255	
idEquipement	<pi> A50	<M>

Screen

idEquipement	A50	<M>
topScreen	SF	
bottomScreen	SF	
diameterScreen	SF	
slotWidth	SF	
openArea	SF	
remarks	A100	
idScreen	<pi> A50	<M>

Casing

idEquipement	A50	<M>
topCasing	SF	
bottomCasing	SF	
diameterCasing	SF	
natureCasing	A5	
remarks	A100	
idCasing	<pi> A50	<M>

ClayPlug

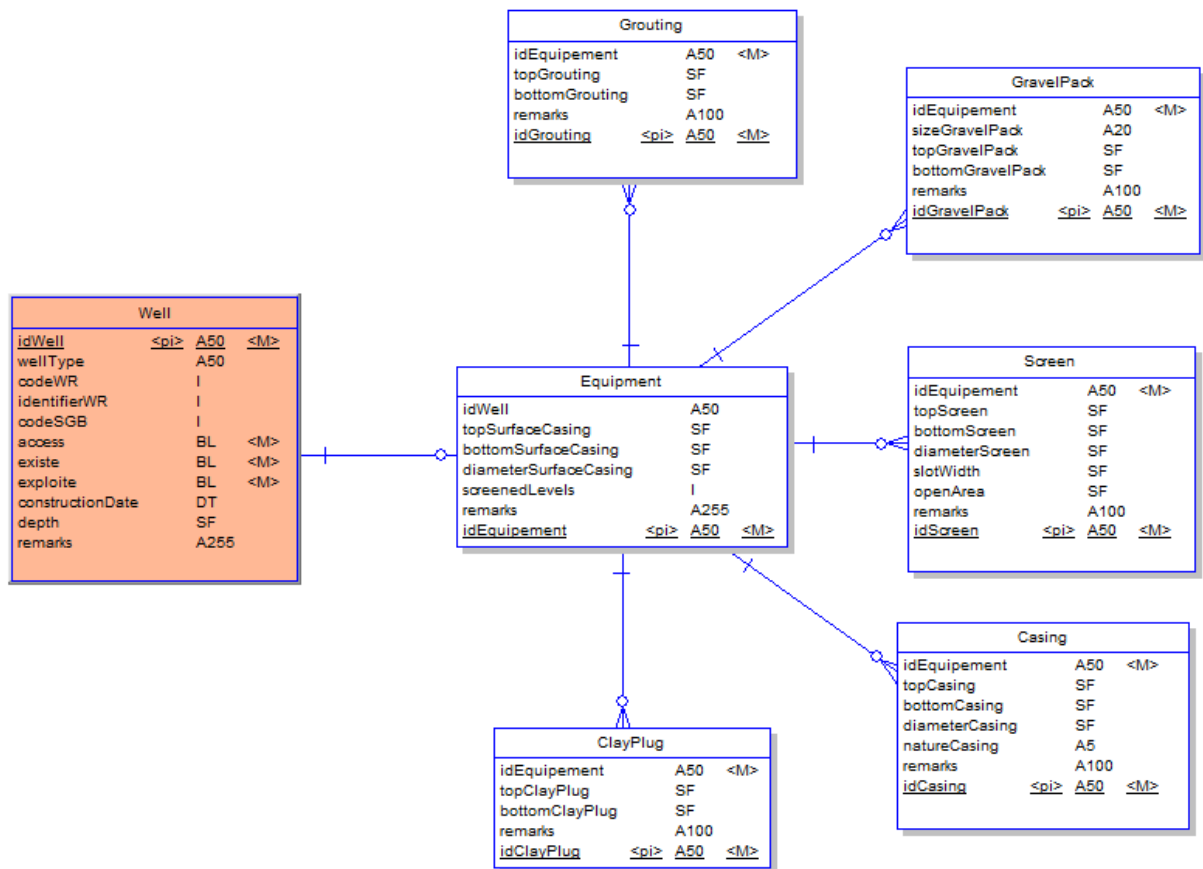|		
idEquipement	A50	<M>
topClayPlug	SF	
bottomClayPlug	SF	
remarks	A100	
idClayPlug	<pi> A50	<M>

Figure ESM 3. Relationships between well and its equipment entities.
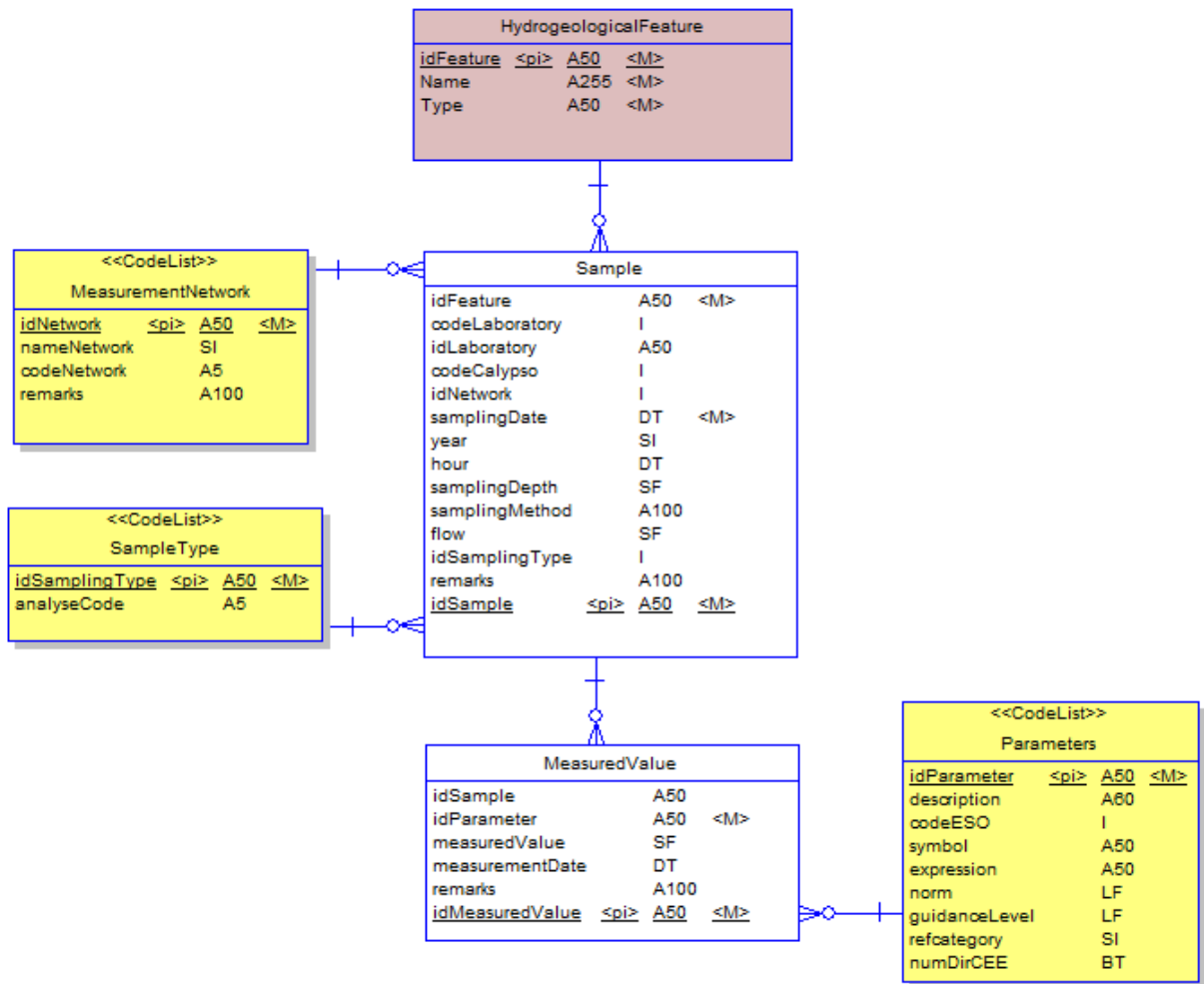
Figure ESM 4. Entity-relationship diagram for chemical analysis sub-model.

PiezometricHeads

idFeature	A50	<M>
measurementDate	DT	<M>
measurement	SF	
altitude	SF	<M>
idRreference	A50	
nullReason	A30	
measurementMethod	A25	
measurementOperator	A100	
remarks	A255	
idPiezometricHead	<pi> A50	<M>

AltitudeReference

idFeature	A50	<M>
elementType	A50	<M>
altitude	SF	<M>
altitudeDate	DT	
zAccuracy	A1	<M>
piezometricReference	BL	<M>
remarks	A255	
idReference	<pi> A50	<M>

Point

idFeature	<pi> A50	<M>
pointType	A50	
idMapQ	I	
idMap	I	
x	F	<M>
y	F	<M>
coordinatesAccuracy	A1	<M>
zGround	F	<M>
zAccuracy	A1	<M>
hydrologicBasin	I	
address	A60	
site	A50	
idDistrict	I	
remarks	A255	
codeINS	I	

Table: Point

idFeature	pointType	x	y	coordinatesAccuracy	zGround	zAccuracy
ULGGEO01_01	well	165001	201004	GPS	21,25	GPS
ULGGEO01_02	well	165005	201007	GPS	20,92	GPS

Table: PiezometricHeads

idFeature	measurementDate	measurement	altitude	idReference	idPiezometricHead
ULGGEO01_01	12/02/2008	7,00	14,41	RW01_01	ULGGEO01_41
ULGGEO01_01	13/02/2008	6,98	14,43	RW01_01	ULGGEO01_42
ULGGEO01_01	14/02/2008	6,96	14,45	RW01_01	ULGGEO01_43
ULGGEO01_01	15/02/2008	6,97	14,44	RW01_01	ULGGEO01_44
ULGGEO01_02	12/10/2007	13,12	7,80		ULGGEO01_91
ULGGEO01_02	13/10/2007	13,14	7,78		ULGGEO01_92

Table: AltitudeReference

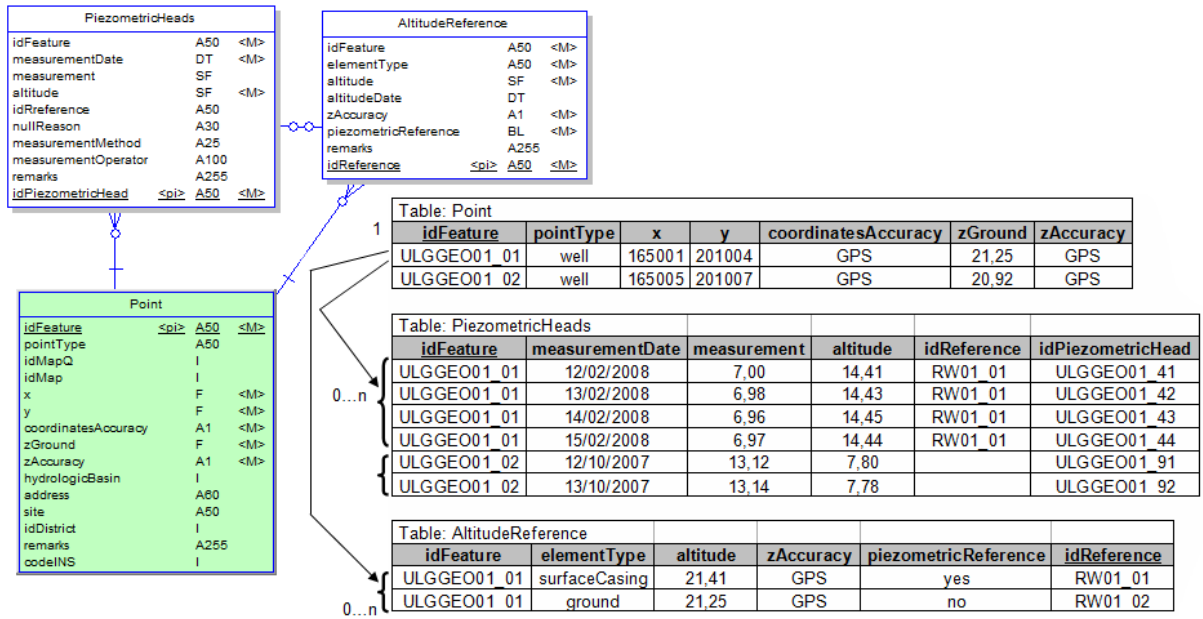| idFeature	elementType	altitude	zAccuracy	piezometricReference	idReference
ULGGEO01_01	surfaceCasing	21,41	GPS	yes	RW01_01
ULGGEO01_01	ground	21,25	GPS	no	RW01_02

Figure ESM 5. Point entity with its piezometric head measurements and an example of implementation.