# Using DPR's Surface Water Database

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Environmental Monitoring

Salton Sea, Imperial County

Photo: Kean Goh

## Surface Water Database

- What is the Surface Water database?

- What is in the database?

- What can be done with the data?

- How do you get the data?

## What is the Surface Water Database?

- A database containing pesticide concentation data from a wide variety of environmental monitoring studies designed to test for the presence or absence of pesticides in California surface waters

- The purpose of the database is to collect and make available information concerning the presence of pesticides in California surface waters

- As part of the Surface Water Protection Program, DPR uses monitoring data from the database in the development of monitoring, mitigation, modeling, policy and regulatory efforts

- More information at http://www.cdpr.ca.gov/docs/emon/surfwtr/surfdata.htm

## What is in the database?

- Monitoring results for pesticides in California surface water (and sediment)
- Over 275,000 analyses; over 20,000 detections
- Data from over 700 sites in 48 counties
- Results for over 250 analytes
- Data from USGS NAWQA, Coalition monitoring, Sac River Watershed Program, SWAMP, as well as DPR and others

Sample sites in database

70 Miles

May 2008

## What is in the database?

- When: Date sampled
- Where: Location of water body sampled (lat/long)
- What: Chemical sampled and results
- Who: Agency or organization who sampled
- How: methodology such as analytical method, sampling equipment, sample type (short descriptions)
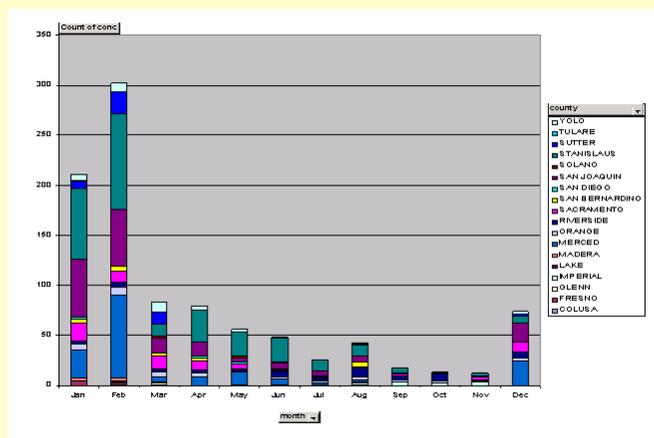- Why: Reference to background information (reports, protocols, etc.) when applicable/available

What can be done with the data?

A few examples……..

Russian River, Geyserville

Photo: K. Starner
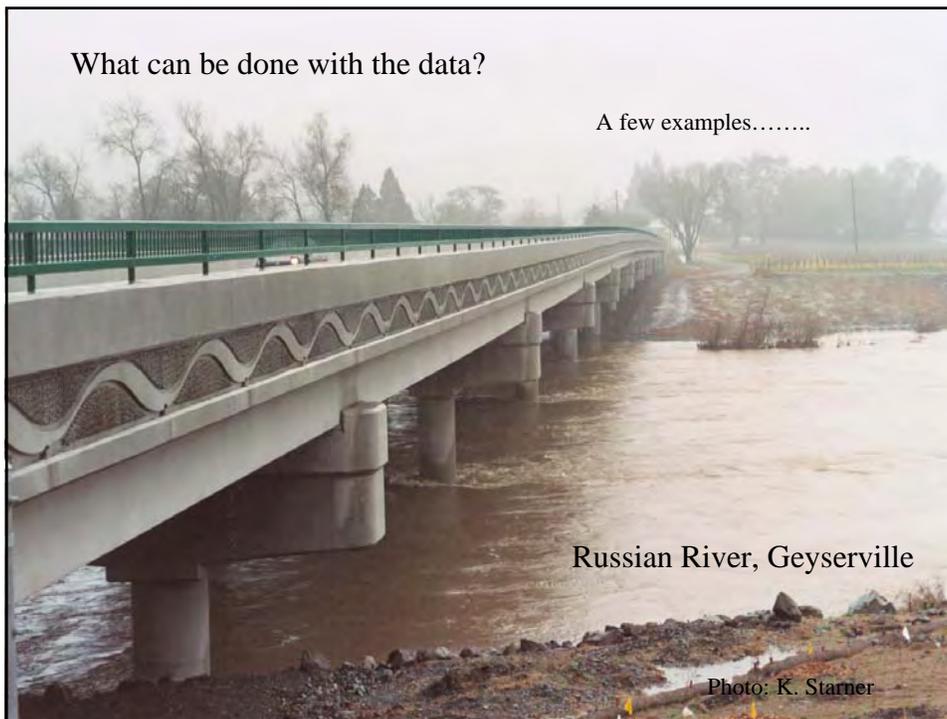


Analysis of detections

Simazine Detections by County and Month (1996-2006)

Bergin et al  2008

## Statistical analyses

Figure 1. Cumulative frequency distribution of 18419 unique detections in SURF
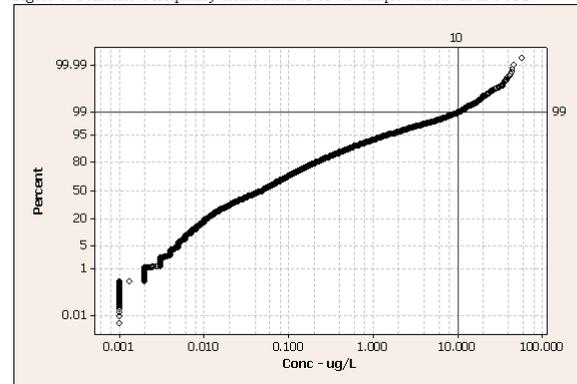


Spurlock, unpublished data

## Mapping/Spatial Analysis



Dimethoate Samples in Database
since 2003

## Mapping/Spatial Analysis
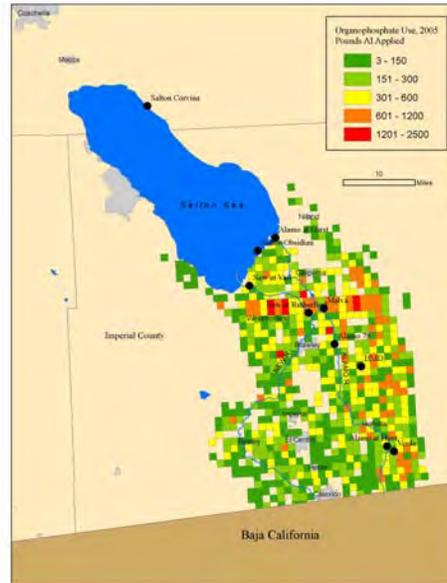


Figure 8. Imperial County Organophosphate Use, 2005.

## Site Assessment

Site assessment

site1



How do you get the data?

Grayson Creek, Martinez

Photo: Mike Ensminger
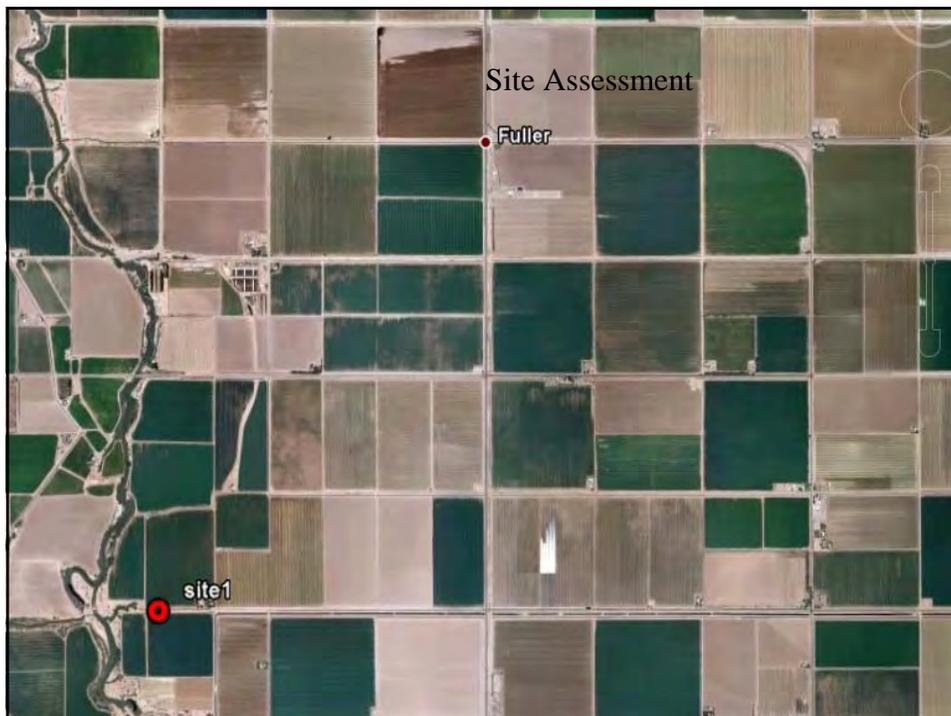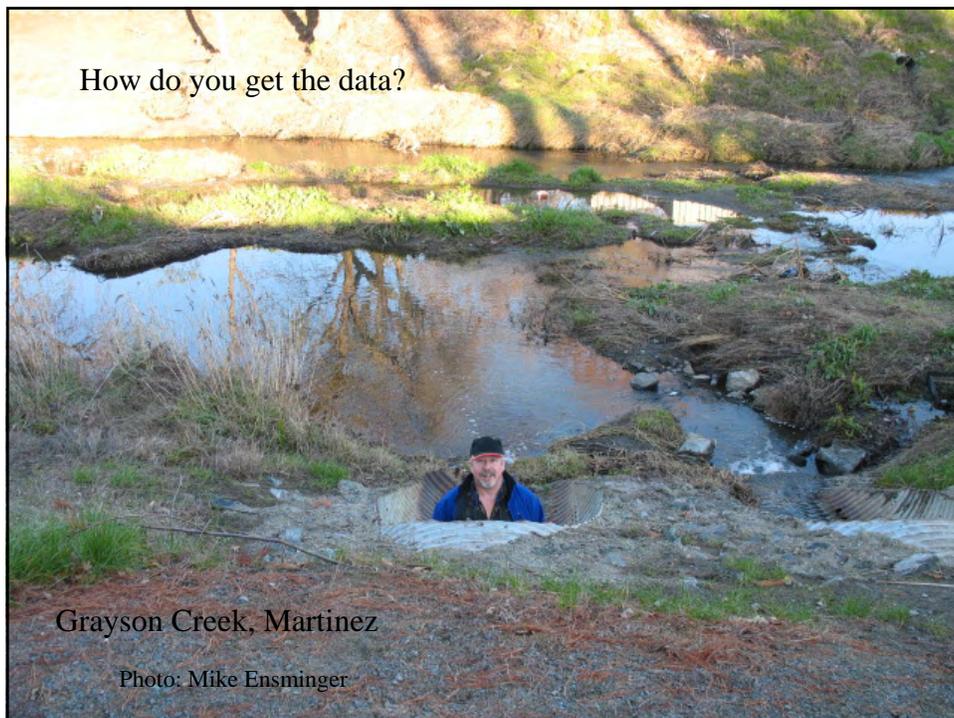
## How do you get the data?

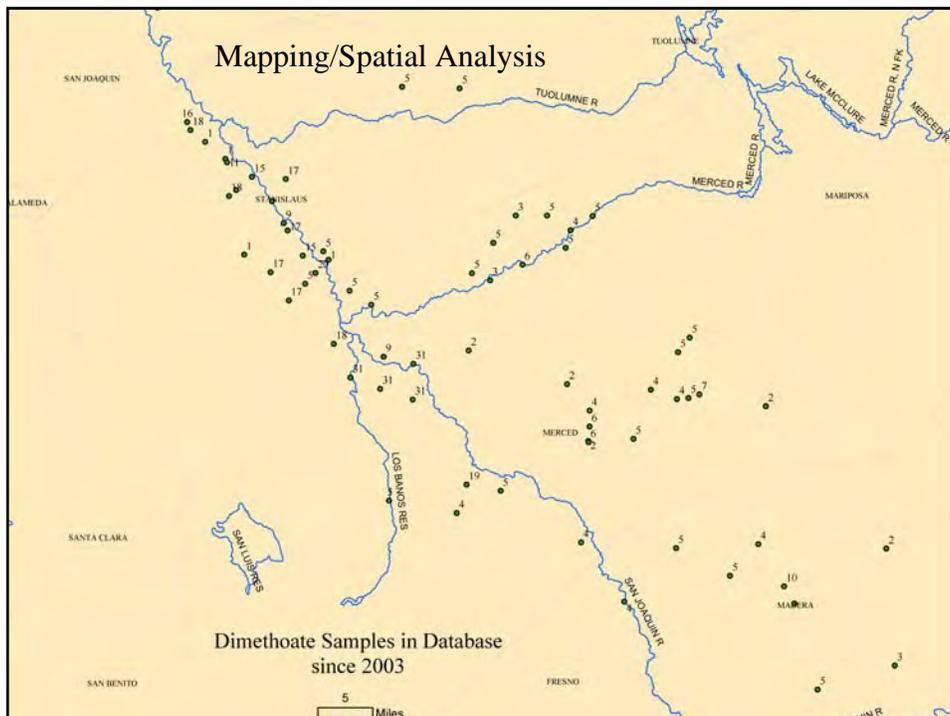- Access data from spreadsheets

- Query main database using SQL

## Accessing data from spreadsheets

- Full contents of database are available in a set of spreadsheets [http://www.cdpr.ca.gov/docs/emon/surfwtr/surfcont.htm, currently being updated]
- Allows accessing data without use of SQL

- Not as versatile as querying full database
- Spreadsheets are updated less frequently than full database
- Requires multiple spreadsheets for all data

## Accessing data from spreadsheets

| County_Name | site description | chemical | date | Conc [ug/L] | loq | study_cd | latitude | longitude |
|---|---|---|---|---|---|---|---|---|
| IMPERIAL | Alamo River downstream of Verde Drain | carbofuran | 3/15/1993 | 5.15 | 0.05 | 13 | 32.7669 | -115.3547 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 11/12/1996 | 5.06 | 0.005 | 77 | 33.2073 | -115.6138 |
| CONTRA COSTA | Marsh Creek at Cypress Rd bridge (IWTFL) | diuron | 2/10/1992 | 4.5 | 0.4 | 43 | 37.9915 | -121.7083 |
| IMPERIAL | Alamo River downstream of Verde Drain | diuron | 2/14/1994 | 4.4 | 0.4 | 13 | 32.7669 | -115.3547 |
| SANTA CRUZ | Beach Street Drainage Ditch located above tide | toxaphene | 1/27/1995 | 3.9 | 1 | 60 | 36.8749 | -121.8069 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 10/1/1996 | 3.35 | 0.005 | 77 | 33.2063 | -115.6126 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 10/31/1996 | 3.25 | 0.005 | 77 | 33.2073 | -115.6138 |
| IMPERIAL | Alamo River at Garst | atrazine | 2/27/1997 | 3.18 | 0.005 | 77 | 33.1992 | -115.5962 |
| IMPERIAL | Alamo River at Garst | carbofuran | 2/27/1997 | 3.01 | 0.008 | 77 | 33.1992 | -115.5962 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 11/12/1996 | 2.65 | 0.005 | 77 | 33.2073 | -115.6138 |
| IMPERIAL | Alamo River at Worthington Road | carbofuran | 3/15/1993 | 2.53 | 0.05 | 13 | 32.8472 | -115.4333 |
| IMPERIAL | Alamo River at Garst | carbofuran | 3/5/1997 | 2.45 | 0.008 | 77 | 33.1992 | -115.5962 |
| SANTA CRUZ | Pajaro River Lagoon located in the Watsonville | toxaphene | 1/27/1995 | 2.4 | 1 | 60 | 36.8605 | -121.8073 |
| IMPERIAL | Alamo River at Holtville WTP | diuron | 11/1/1993 | 2.2 | 0.4 | 13 | 32.8064 | -115.4331 |
| IMPERIAL | Alamo River at Outlet | linuron | 12/13/1993 | 0.56 | 0.07 | 13 | 33.1992 | -115.5964 |
| IMPERIAL | Alamo River downstream of Verde Drain | methomyl | 11/1/1993 | 0.56 | 0.07 | 13 | 32.7669 | -115.3547 |
| IMPERIAL | Alamo River at Garst | diazinon | 10/1/1996 | 0.553 | 0.003 | 77 | 33.1992 | -115.5962 |
| SAN BERNARDINO | Warm C Nr TE PPAH | tebuthiuron | 9/28/1999 | 0.546 | 0.005 | 100 | 34.0778 | -117.3 |
| IMPERIAL | Alamo River at Albright Road (Nectarine Drain | diazinon | 10/4/1993 | 0.53 | 0.1 | 13 | 33.1028 | -115.5431 |
| IMPERIAL | In Salton Sea at mouth of Alamo River, approx. | eptc | 9/10/1996 | 0.525 | 0.005 | 77 | 33.2063 | -115.6126 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | chlorthal-dimet | 10/1/1996 | 0.523 | 0.003 | 77 | 33.2073 | -115.6138 |
| IMPERIAL | Alamo River downstream of Verde Drain | carbofuran | 2/14/1994 | 0.52 | 0.07 | 13 | 32.7669 | -115.3547 |

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## Querying main database using SQL

- Requires knowledge of SQL

- Requires an understanding of the structure of the database

- Very versatile and powerful

## Accessing the database

- Access the database through SQLPlus (most are set up already)

- Use the "staff/staff" log-in

- Edit queries through Notepad
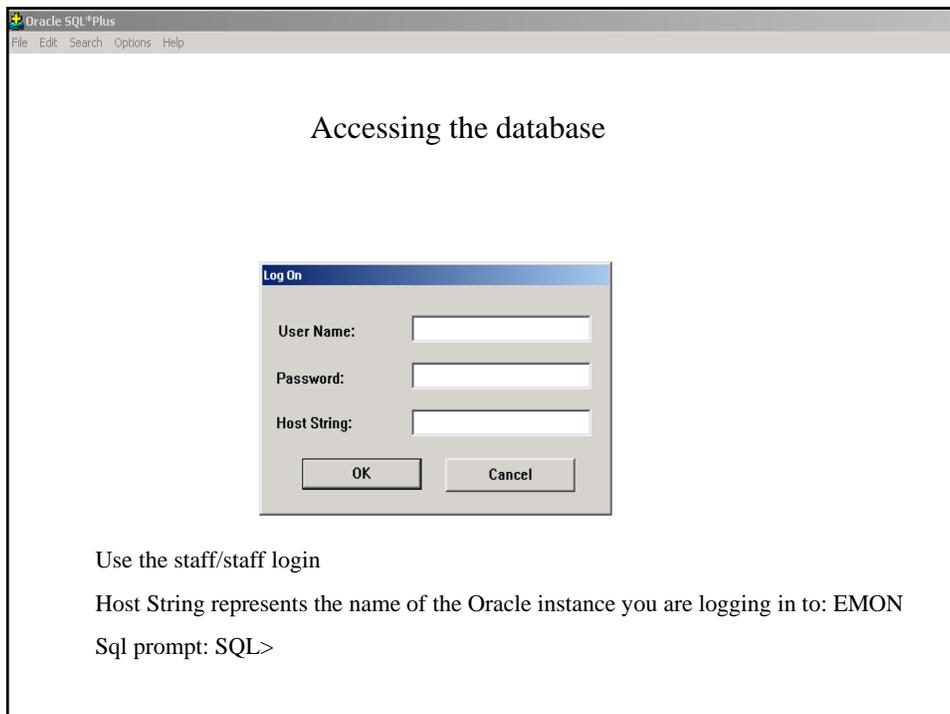
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Oracle SQL*Plus
File   Edit   Search   Options   Help

## Accessing the database

| Log On | |
|---|---|
| User Name: | |
| Password: | |
| Host String: | |
| OK | Cancel |

Use the staff/staff login

Host String represents the name of the Oracle instance you are logging in to: EMON

Sql prompt: SQL>

Structure of the database

Aerial view, Imperial Valley
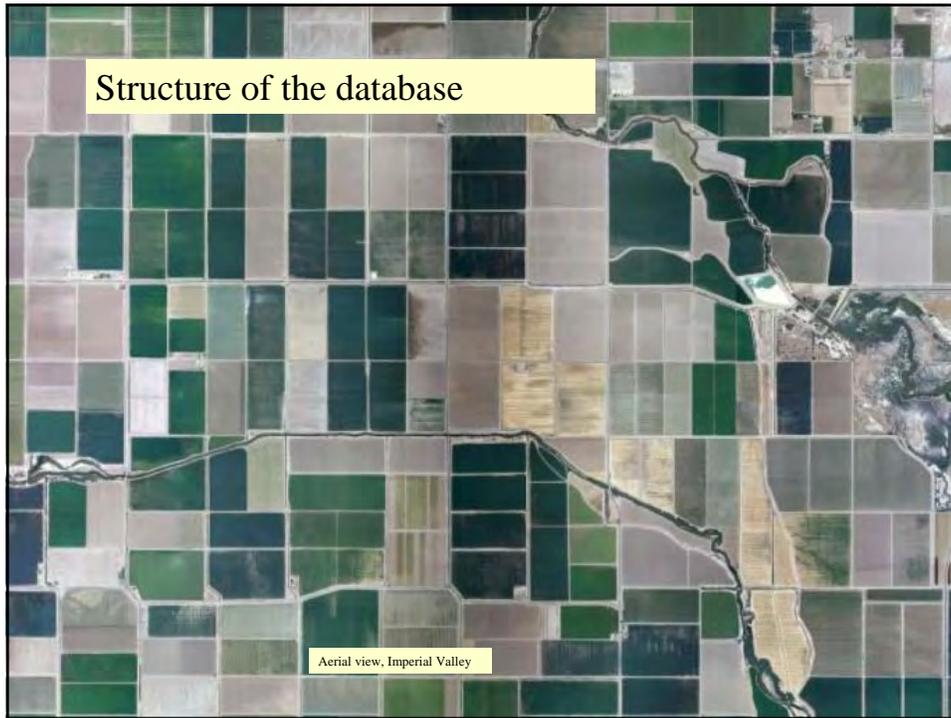
## Previous example (spreadsheets)

| County_Name | site description | chemical | date | Conc [ug/L] | loq | study_cd | latitude | longitude |
|---|---|---|---|---|---|---|---|---|
| IMPERIAL | Alamo River downstream of Verde Drain | carbofuran | 3/15/1993 | 5.15 | 0.05 | 13 | 32.7669 | -115.3547 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 11/12/1996 | 5.06 | 0.005 | 77 | 33.2073 | -115.6138 |
| CONTRA COSTA | Marsh Creek at Cypress Rd bridge (IWTFL) | diuron | 2/10/1992 | 4.5 | 0.4 | 43 | 37.9915 | -121.7083 |
| IMPERIAL | Alamo River downstream of Verde Drain | diuron | 2/14/1994 | 4.4 | 0.4 | 13 | 32.7669 | -115.3547 |
| SANTA CRUZ | Beach Street Drainage Ditch located above tide | toxaphene | 1/27/1995 | 3.9 | 1 | 60 | 36.8749 | -121.8069 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 10/1/1996 | 3.35 | 0.005 | 77 | 33.2063 | -115.6126 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 10/31/1996 | 3.25 | 0.005 | 77 | 33.2073 | -115.6138 |
| IMPERIAL | Alamo River at Garst | atrazine | 2/27/1997 | 3.18 | 0.005 | 77 | 33.1992 | -115.5962 |
| IMPERIAL | Alamo River at Garst | carbofuran | 2/27/1997 | 3.01 | 0.008 | 77 | 33.1992 | -115.5962 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | eptc | 11/12/1996 | 2.65 | 0.005 | 77 | 33.2073 | -115.6138 |
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| IMPERIAL | Alamo River at Garst | carbofuran | 3/5/1997 | 2.45 | 0.008 | 77 | 33.1992 | -115.5962 |
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| IMPERIAL | Alamo River at Garst | diazinon | 10/1/1996 | 0.553 | 0.003 | 77 | 33.1992 | -115.5962 |
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| IMPERIAL | In Salton Sea at mouth of Alamo River, approx. | eptc | 9/10/1996 | 0.525 | 0.005 | 77 | 33.2063 | -115.6126 |
| IMPERIAL | Lat/long approx. In Salton Sea at mouth of Alam | chlorthal-dimet | 10/1/1996 | 0.523 | 0.003 | 77 | 33.2073 | -115.6138 |
| IMPERIAL | Alamo River downstream of Verde Drain | carbofuran | 2/14/1994 | 0.52 | 0.07 | 13 | 32.7669 | -115.3547 |

Data are not actually in one table in the database

Rather, one "main" data table and multiple "look-up" tables

MAIN DATA TABLE

"SURF"

| SAMP_DATE | CHEM_CD | CONC | LOQ | COUNTY_CD | LOC_CD | STUDY_CD |
|---|---|---|---|---|---|---|
| 3/1/2006 | 216 | 0.0372 | 0.05 | 9 | 3 | 102 |
| 7/13/2004 | 216 | 0.05 | 0.05 | 10 | 22 | 102 |
| 7/5/2005 | 216 | 1.06 | 0.05 | 10 | 4 | 102 |
| 3/15/1993 | 216 | 1.44 | 0.05 | 13 | 7 | 13 |
| 3/15/1993 | 216 | 0.28 | 0.05 | 13 | 8 | 13 |
| 3/15/1993 | 216 | 0.47 | 0.05 | 13 | 9 | 13 |
| 3/15/1993 | 216 | 1.39 | 0.05 | 13 | 20 | 13 |
| 3/15/1993 | 216 | 0.23 | 0.05 | 13 | 21 | 13 |
| 1/24/1994 | 216 | 0.066 | 0.05 | 13 | 8 | 13 |
| 1/24/1994 | 216 | 0.35 | 0.1 | 13 | 20 | 13 |
| 1/24/1994 | 216 | 0.106 | 0.05 | 13 | 20 | 13 |
| 1/24/1994 | 216 | 0.067 | 0.05 | 13 | 9 | 13 |
| 5/13/2002 | 216 | 0.057 | 0.05 | 13 | 47 | 101 |
| 5/14/2002 | 216 | 0.067 | 0.05 | 13 | 49 | 101 |
| 5/14/2002 | 216 | 0.055 | 0.05 | 13 | 52 | 101 |
| 3/23/2005 | 216 | 0.0516 | 0.04 | 13 | 24 | 83 |
| 3/23/2005 | 216 | 0.069 | 0.04 | 13 | 10 | 83 |
| 3/23/2005 | 216 | 0.119 | 0.04 | 13 | 25 | 83 |
| 4/15/1992 | 216 | 2.03 | 0.05 | 24 | 8 | 10 |
| 4/15/1992 | 216 | 2.23 | 0.05 | 24 | 8 | 10 |
| 7/28/1992 | 216 | 0.23 | 0.05 | 24 | 8 | 10 |
| 8/25/1992 | 216 | 0.88 | 0.05 | 24 | 8 | 10 |
| 9/5/1994 | 216 | 0.13 | 0.05 | 24 | 6 | 14 |
| 9/26/1994 | 216 | 0.13 | 0.05 | 24 | 6 | 14 |
| 7/29/2002 | 216 | 0.0462 | 0.04 | 24 | 13 | 76 |

SURF table: standard relational database design (also: SED table)

Codes: chem_cd, loc_cd, instead of chemical names, etc.

MAIN DATA TABLE

"SURF"

| SAMP_DATE | CHEM_CD | CONC | LOQ | COUNTY_CD | LOC_CD | STUDY_CD |
|---|---|---|---|---|---|---|
| 3/1/2006 | 216 | 0.037 | 0.05 | 9 | 3 | 102 |
| 7/13/2004 | 216 | 0.05 | 0.05 | 10 | 22 | 102 |
| 7/5/2005 | 216 | 1.06 | 0.05 | 10 | 4 | 102 |
| 3/15/1993 | 216 | 1.44 | 0.05 | 13 | 7 | 13 |
| 3/15/1993 | 216 | 0.28 | 0.05 | 13 | 8 | 13 |
| 3/15/1993 | 216 | 0.47 | 0.05 | 13 | 9 | 13 |
| 3/15/1993 | 216 | 1.39 | 0.05 | 13 | 20 | 13 |
| 3/15/1993 | 216 | 0.23 | 0.05 | 13 | 21 | 13 |
| 1/24/1994 | 216 | 0.066 | 0.05 | 13 | 8 | 13 |
| 1/24/1994 | 216 | 0.35 | 0.1 | 13 | 20 | 13 |
| 1/24/1994 | 216 | 0.106 | 0.05 | 13 | 20 | 13 |
| 1/24/1994 | 216 | 0.067 | 0.05 | 13 | 9 | 13 |
| 5/13/2002 | 216 | 0.057 | 0.05 | 13 | 47 | 101 |
| 5/14/2002 | 216 | 0.067 | 0.05 | 13 | 49 | 101 |
| 5/14/2002 | 216 | 0.055 | 0.05 | 13 | 52 | 101 |
| 3/23/2005 | 216 | 0.0516 | 0.04 | 13 | 24 | 83 |
| 3/23/2005 | 216 | 0.069 | 0.04 | 13 | 10 | 83 |
| 3/23/2005 | 216 | 0.119 | 0.04 | 13 | 25 | 83 |
| 4/15/1992 | 216 | 2.03 | 0.05 | 24 | 8 | 10 |
| 4/15/1992 | 216 | 2.23 | 0.05 | 24 | 8 | 10 |
| 7/28/1992 | 216 | 0.23 | 0.05 | 24 | 8 | 10 |
| 8/25/1992 | 216 | 0.88 | 0.05 | 24 | 8 | 10 |
| 9/5/1994 | 216 | 0.13 | 0.05 | 24 | 6 | 14 |
| 9/26/1994 | 216 | 0.13 | 0.05 | 24 | 6 | 14 |
| 7/29/2002 | 216 | 0.0462 | 0.04 | 24 | 13 | 76 |

LOOK UP TABLE "CHEM"

| CHEM_CD | NAME |
|---|---|
| 108 | carbon disulfide |
| 110 | carbophenothion |
| 179 | chlorthal-dimethyl |
| 180 | dalapon |
| 181 | fensulfothion |
| 183 | dbcp |
| 184 | ddd |
| 192 | dioxathion |
| 198 | diazinon |
| 200 | dicamba |
| 210 | dieldrin |
| 211 | mancozeb |
| 216 | dimethoate |
| 221 | 2,4-dinitrophenol |
| 226 | diphenamid |
| 229 | diquat dibromide |
| 230 | disulfoton |
| 231 | diuron |

LOOK UP TABLE "COUNTY"

| county_cd | name |
|---|---|
| 1 | Alameda |
| 2 | Alpine |
| 3 | Amador |
| 4 | Butte |
| 5 | Calaveras |
| 6 | Colusa |
| 7 | Contra Costa |
| 8 | Del Norte |
| 9 | El Dorado |
| 10 | Fresno |
| 11 | Glenn |
| 12 | Humboldt |
| 13 | Imperial |

Chemical and county names are in separate tables, with their respective codes.

Through queries, join the tables and get the chemical name from the code, etc.

Surface Water Database Documentation
May 2008

**SURF - surface water analysis** - Analytical results for pesticides in water samples taken from California surface water.

| Field Name | Description |
|---|---|
| study_cd | Number assigned to a monitoring study for database tracking purposes. |
| county_cd | County code established by numbering an alphabetized list of California's 58 counties. For example, '01' = Alameda; '58' = Yuba. |
| loc_cd | Number assigned to each sampling site. When combined with the county_cd, provides a unique code for each sampling site. |
| samp_date | Date of sampling. |
| extrac_date | Date of sample extraction. |
| anly_date | Date of analysis. |
| agency_cd | Code assigned to each agency or other organization conducting and reporting surface water monitoring data. |
| chem_cd | DPR code for pesticide active ingredients and breakdown products. |
| conc | Concentration of the analyte in ug/L (parts per billion). Non-detects are reported as zero. Concentrations below the limit of quantitation are reported in the database as zero. See 'trace'. |
| loq | Limit of quantitation reported for the analytical method in ug/L (parts per billion). |
| coll_meth_cd | Code assigned for each sample collection method (e.g. grab). |
| anly_meth_cd | Code assigned for each method of analysis (e.g. GC/MS). |
| sampler_cd | Code assigned for the type of sampler used to collect sample (e.g. composite autosampler). |
| samp_type_cd | Code assigned for each type of sample (e.g., filtered or whole water). |
| samp_id | Used to distinguish between duplicate samples taken on same day. |
| lab_cd | Code assigned to each analytical laboratory. |
| storm_flag | "Y" indicates sample was taken during a storm event to determine pesticide loading in runoff water. |
| rmk_flag | Indicates information in remarks field. "*" = other; "E" = estimated. |
| remarks | Supplemental information pertaining to a sample (e.g., concentration of 0.03 ppb was reported below the loq of 0.05 ppb). |
| samp_time | Time of day for sample collection. |
| trace_flag | Indicates a trace detection (analyte was detected, but at concentration too low for accurate quantification). |
| samp_id2 | Original ID. For DPR samples, samp_id2 is the study code followed by the field-assigned sample number. |

Descriptions of field (column) contents

Full documentation available for all tables



Table Relationships- Chemical Analysis Information (SURF)   Updated 5/2008

Each box (with a gray header) is a table in the database- the gray box is the name of the table and the others are fields in the table.

SURF and SED are separate tables but have identical field names except as indicated.

Querying the database

Blue Rock Springs Creek, Vallejo

Photo: Mike Ensminger
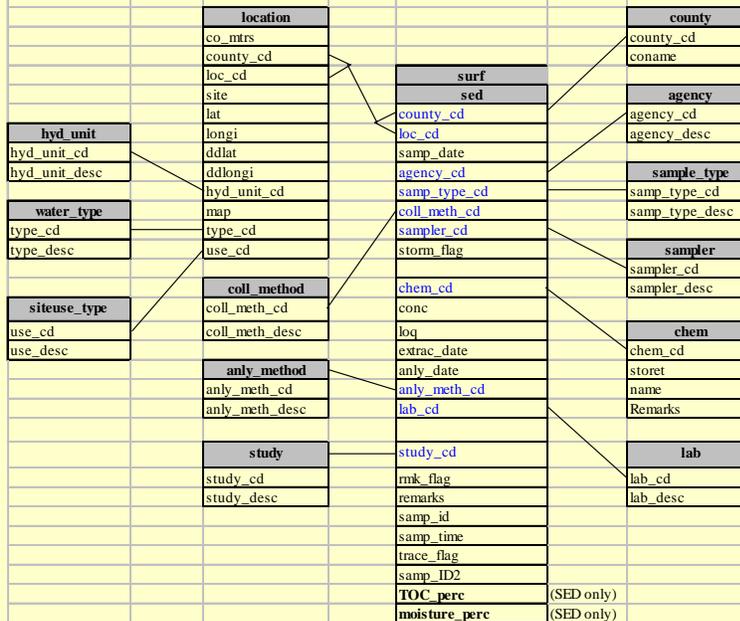
## Basic Query – No Joins

Querying the main data table (SURF) only, no lookup tables

select samp_date, chem_cd, conc, loq, county_cd, loc_cd, study_cd

from surf

where chem_cd=216

and county_cd=50

and conc>1

order by samp_date

## Basic Query – No Joins

**select samp_date, chem_cd, conc, loq, county_cd, loc_cd, study_cd**

from surf

where chem_cd=216

and county_cd=50

and conc>1

Order by samp_date

**SELECT statement:**

samp_date: date that sample was collected

chem_cd: chemical code for the pesticide (look up) [chem_cd 216 = dimethoate]

conc: concentration, in ug/L. Nondetects shown as zero

loq: limit of quantitation/reporting limit in ug/L

county_cd: code for county where the sample was collected (look up) [50=Stanislaus]

loc_cd: location code for the specific sample site – paired with the county code for unique identification (look up)

study_cd: code for the monitoring study – (not the DPR study number) (look up)

## Basic Query – No Joins

select samp_date, chem_cd, conc, loq, county_cd, loc_cd, study_cd

**from surf**

**where chem_cd=216**

**and county_cd=50**

**and conc>1**

**order by samp_date**

from surf: all data are in the main SURF table

where chem._cd=216: only data for chem._cd 216 (dimethoate) are included in the query

and county_cd=50: only county code 50 (Stanislaus) included

and conc>1: only samples with concentration greater than 1 are included

order by samp_date: results are in order of date sampled

```
  1   select samp_date, chem_cd, conc, loq, county_cd, loc_cd, study_cd
  2   from surf
  3   where chem_cd=216
  4   and county_cd=50
  5   and conc>1
  6*  order by samp_date
SQL> /

SAMP_DATE    CHEM_CD      CONC       LOQ CO    LOC_CD   STUDY_CD
---------- ---------- ---------- ---------- -- ---------- ----------
1991/09/06      216        1.05       .05 50        23         10
1992/08/19      216        2.44       .05 50        29         10
2003/07/15      216        1.2        .04 50        28         82
2003/07/22      216        1.05       .04 50        28         82
2003/07/22      216        2.36       .04 50        32         82
2003/07/29      216        6.62       .04 50        31         82
2003/08/12      216        1.24       .04 50        28         82
2003/08/19      216        5.46       .04 50        32         82
2003/08/26      216        1.57       .04 50        28         82
2003/08/26      216        1.7        .04 50        31         82
2003/09/09      216        5.72       .04 50        31         82
2003/09/16      216        7.73       .04 50        31         82
2003/09/30      216        1.07       .04 50        28         82
2004/07/06      216        3              50        59        102
2004/07/06      216        1.9            50        69        102
2004/08/10      216        1.4            50        80        102
2005/08/09      216        1.9            50        69        102
2005/08/09      216        1.1            50        71        102
2005/08/09      216        1.3            50        59        102
2006/04/04      216        2.9            50        68        102
2006/07/11      216        1.4            50        59        102
2006/07/11      216        1.2            50        68        102
2006/08/08      216        1.7            50        59        102
2006/08/09      216        1.8            50        71        102

24 rows selected.
```

## Basic Query – No Joins

```
SAMP_DATE    CHEM_CD      CONC       LOQ CO    LOC_CD   STUDY_CD
---------- ---------- ---------- ---------- -- ---------- ----------
1991/09/06      216        1.05       .05 50        23         10
1992/08/19      216        2.44       .05 50        29         10
2003/07/15      216        1.2        .04 50        28         82
2003/07/22      216        1.05       .04 50        28         82
2003/07/22      216        2.36       .04 50        32         82
2003/07/29      216        6.62       .04 50        31         82
2003/08/12      216        1.24       .04 50        28         82
2003/08/19      216        5.46       .04 50        32         82
2003/08/26      216        1.57       .04 50        28         82
2003/08/26      216        1.7        .04 50        31         82
2003/09/09      216        5.72       .04 50        31         82
2003/09/16      216        7.73       .04 50        31         82
2003/09/30      216        1.07       .04 50        28         82
2004/07/06      216        3              50        59        102
2004/07/06      216        1.9            50        69        102
2004/08/10      216        1.4            50        80        102
2005/08/09      216        1.9            50        69        102
2005/08/09      216        1.1            50        71        102
2005/08/09      216        1.3            50        59        102
2006/04/04      216        2.9            50        68        102
2006/07/11      216        1.4            50        59        102
2006/07/11      216        1.2            50        68        102
2006/08/08      216        1.7            50        59        102
2006/08/09      216        1.8            50        71        102
```

Query results can be used in conjunction with lookup tables (also available in spreadsheet form)

Determine sample sites, chemical, etc for quick use

## Look up tables in Excel – Location table excerpt

| CO | LOC_CD | co_loc | SITE | DDLAT | DDLONGI |
|----|--------|--------|------|-------|---------|
| 50 | 13 | 50_13 | Tuolumne River at Roberts Ferry Bridge | 37.63583 | -120.61722 |
| 50 | 14 | 50_14 | Ingram/Hospital Creek (trib. to SJR) | 37.61583 | -121.20417 |
| 50 | 15 | 50_15 | San Joaquin River at Laird Park | 37.56167 | -121.15167 |
| 50 | 16 | 50_16 | Tuolumne River at Shiloh | 37.60333 | -121.13055 |
| 50 | 17 | 50_17 | Tuolumne River at Carpenter Rd Bridge | 37.60889 | -121.02972 |
| 50 | 18 | 50_18 | Del Puerto Creek (trib. to SJR) | 37.53917 | -121.12056 |
| 50 | 19 | 50_19 | Turlock Irrig. Dist. Drain #3 at Jennings Rd Bridge | 37.53694 | -121.06611 |
| 50 | 20 | 50_20 | Tuolumne River at Mitchell Rd Bridge | 37.61694 | -120.93778 |
| 50 | 21 | 50_21 | Westside stormdrain at Neece Dr, Modesto | 37.62528 | -120.99833 |
| 50 | 22 | 50_22 | Turlock Irr Dist Ceres Main Spillway | 37.61083 | -120.91944 |
| 50 | 23 | 50_23 | San Joaquin River at West Main | 37.49333 | -121.07944 |
| 50 | 24 | 50_24 | Turlock Irrig. Dist. Drain #5 | 37.46444 | -121.03 |
| 50 | 25 | 50_25 | Spanish Grant Drain (trib. to SJR) | 37.43556 | -121.03222 |
| 50 | 26 | 50_26 | Orestimba Creek at State Hwy. 33 bridge | 37.37722 | -121.05694 |
| 50 | 27 | 50_27 | Orestimba Creek above Crow Creek Drain | 37.37139 | -121.06167 |
| 50 | 28 | 50_28 | Orestimba Creek at River Road (trib. to SJR) | 37.41361 | -121.015 |
| 50 | 29 | 50_29 | San Joaquin River at Hills Ferry | 37.34944 | -120.97528 |
| 50 | 30 | 50_30 | Westport Drain at Quisenberry Road | 37.53955 | -121.0842 |
| 50 | 31 | 50_31 | Unamed Drain at Pomelo Ave nr Paradise Ave, drains to San Joaquin River | 37.46924 | -121.0619 |
| 50 | 32 | 50_32 | Del Puerto Creek at Vineyard Ave. (trib to San Joaquin River) | 37.52174 | -121.14806 |
| 50 | 33 | 50_33 | San Joaquin River at Crows Landing | 37.43174 | -121.01225 |
| 50 | 34 | 50_34 | Westport Drain Nr Modesto California_USGS NAWQA site | 37.54224 | -121.094 |

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## (Slightly) more sophisticated queries

- Can write a query to return the same sample data in a more complete and useful format

- Can use joins, column aliases, table aliases, other formatting techniques

Query with joins, etc.

**select a.samp_date as sampled_on,**

**substr(b.name,1,10) as chemical,**

**a.conc as conc_ppb,**

**substr(d.coname,1,12) as county,**

**substr(c.agency_desc,1,50) as conducting_agency,**

**a.study_cd**

**from surf a, chem b, agency c, county d**

**where a.chem_cd=b.chem_cd**

**and a.agency_cd=c.agency_cd**

**and a.county_cd=d.county_cd**

**and a.chem_cd=216**

**and a.county_cd=50**

**and a.conc>1**

```
SAMPLED_ON CHEMICAL     CONC_PPB COUNTY       CONDUCTING_AGENCY                                  STUDY_CD
---------- ---------- ---------- ------------ -------------------------------------------------- ---
1991/09/06 dimethoate       1.05 STANISLAUS   California Department of Pesticide Regulation             10
1992/08/19 dimethoate       2.44 STANISLAUS   California Department of Pesticide Regulation             10
2003/07/15 dimethoate        1.2 STANISLAUS   California Department of Pesticide Regulation             82
2003/07/22 dimethoate       1.05 STANISLAUS   California Department of Pesticide Regulation             82
2003/07/22 dimethoate       2.36 STANISLAUS   California Department of Pesticide Regulation             82
2003/07/29 dimethoate       6.62 STANISLAUS   California Department of Pesticide Regulation             82
2003/08/12 dimethoate       1.24 STANISLAUS   California Department of Pesticide Regulation             82
2003/08/19 dimethoate       5.46 STANISLAUS   California Department of Pesticide Regulation             82
2003/08/26 dimethoate       1.57 STANISLAUS   California Department of Pesticide Regulation             82
2003/08/26 dimethoate        1.7 STANISLAUS   California Department of Pesticide Regulation             82
2003/09/09 dimethoate       5.72 STANISLAUS   California Department of Pesticide Regulation             82
2003/09/16 dimethoate       7.73 STANISLAUS   California Department of Pesticide Regulation             82
2003/09/30 dimethoate       1.07 STANISLAUS   California Department of Pesticide Regulation             82
2004/07/06 dimethoate          3 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2004/07/06 dimethoate        1.9 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2004/08/10 dimethoate        1.4 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2005/08/09 dimethoate        1.9 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2005/08/09 dimethoate        1.1 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2005/08/09 dimethoate        1.3 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2006/04/04 dimethoate        2.9 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2006/07/11 dimethoate        1.4 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2006/07/11 dimethoate        1.2 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2006/08/08 dimethoate        1.7 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102
2006/08/09 dimethoate        1.8 STANISLAUS   CALIF. REGIONAL WQCB NO. 5 CENTRAL VALLEY REGION        102

24 rows selected.
```

## Query with joins

- A 'join' is a mechanism used to associate multiple tables within a query
- Using special syntax, multiple tables can be joined so that a single output is returned
- The join associates the correct rows in each table 'on-the-fly'

Source: Teach Yourself SQL, Ben Forta

## Query with joins

- Joins the 'MAIN' data table with the 'lookup' tables
- Provides more detail: instead of the chem_cd, returns the actual name of the chemical, etc.
- No need to look up codes manually in look up tables

## Joins, etc.

- Column alias – renaming a column for use in output: 'chem_cd' column head becomes 'Chemical'

- Table alias – in the query, 'renaming' a table:
SURF in the example is 'a'.
Enables the use of the abbreviated 'a' instead of the full text 'surf'

```sql
select a.samp_date as sampled_on,
substr(b.name,1,10) as chemical,
a.conc as conc_ppb,
substr(d.coname,1,12) as county,
substr(c.agency_desc,1,50) as conducting_agency,
a.study_cd
from surf a, chem b, agency c, county d
where a.chem_cd=b.chem_cd
and a.agency_cd=c.agency_cd
and a.county_cd=d.county_cd
and a.chem_cd=216
and a.county_cd=50
and a.conc>1
```

## Learning SQL

- Run/modify practice queries (sample queries available)
- Start simple and progress to more complex
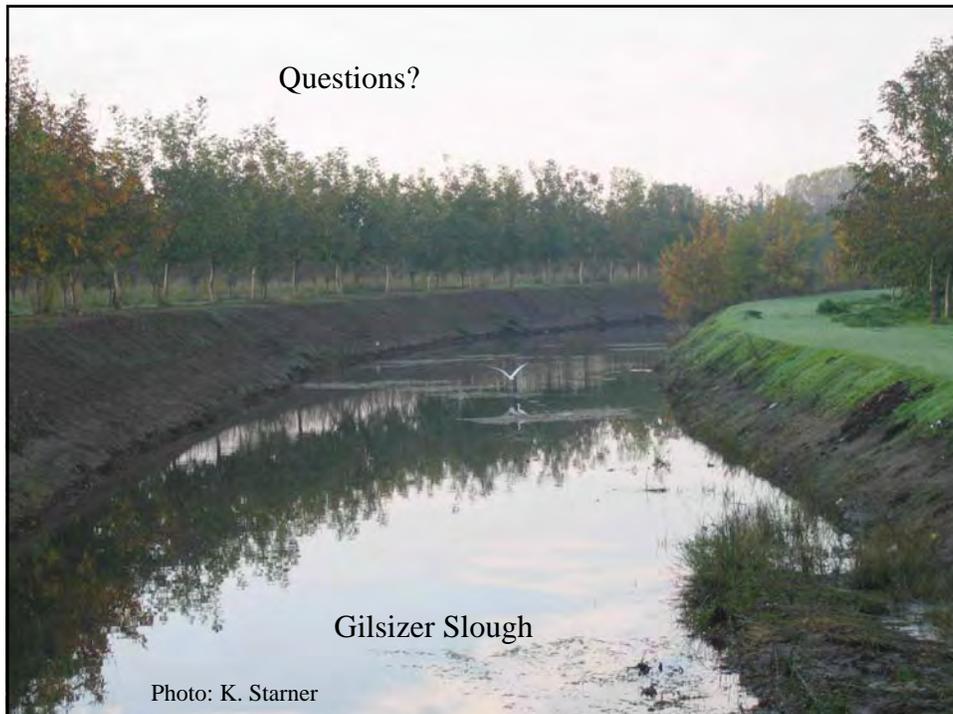
Resources :
    Knowledgeable coworkers
    Classes: University extension, etc.

    Book: Teach Yourself SQL in 10 Minutes (Ben Forta)
    Or….. in 24 hours
    Or….. in 21 days



Questions?

Gilsizer Slough

Photo: K. Starner