Ecology's Quality System – From databases to information sharing and decision-making

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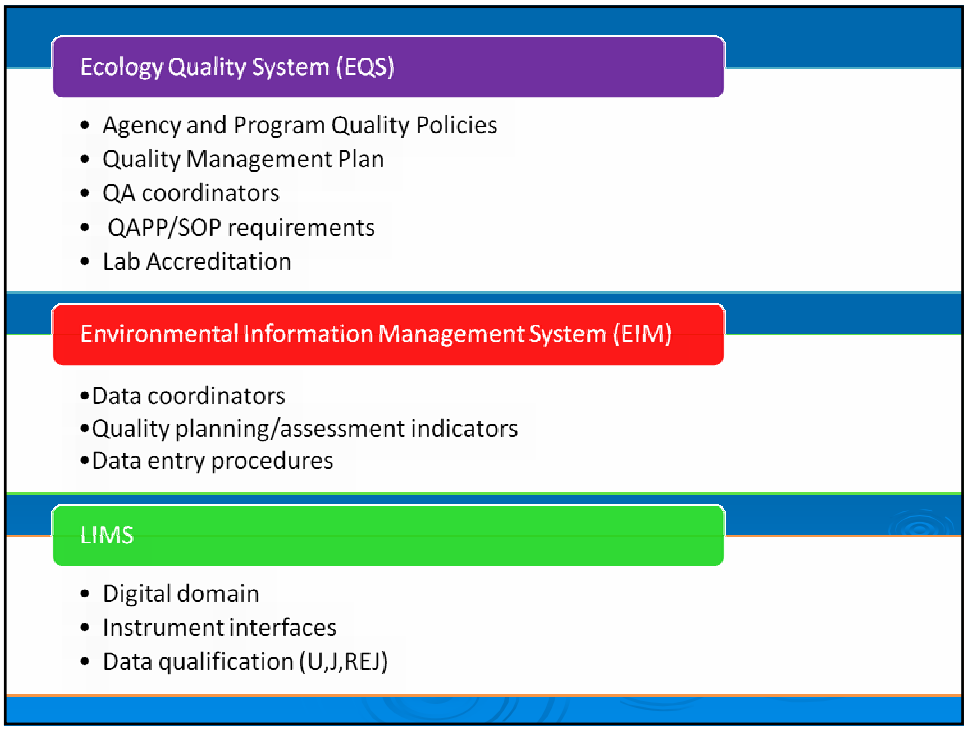
Washington State Department of Ecology
Quality Assurance Officer
April 23, 2008

Innovations in quality system

- Robust, homegrown LIMS system
- EIM environmental database
- Computer-based data submittal
- Lab Accreditation web database access
- Quality Assurance internet site
  - Posting of EPA and Ecology SOPs
  - Posting of Ecology QAPP development tools
- Development of "Credible" data policy
- Decision and info-sharing tools

Ecology's Quality System

- Quality Management Plan is foundation
- Ecology Quality Management Plan (QMP) is required by USEPA
- QMP helps ensure that accurate environmental data are available to support agency decisions
- QMP revised on 5 year cycle
- Authored/revised by Agency QAO



Ecology's Quality System Components

- Quality assurance policy (Ecology Executive Policy 1-21)
- Lab Accreditation Policy (1-22)
- Quality system documentation (Quality Management Plan)
- Periodic reviews and planning (QA Report to Management)
- Systematic planning of projects (Data Quality Objectives Process)

Ecology's Quality System Components

- Project-specific quality documentation (QA Project Plans)
- Project and data assessments (Data Verification/Validation and Data Quality Assessment)
- Management assessments (Quality System Assessment)
- Standard Operating Procedures (SOP) for sampling, field analytical, and lab analytical processes

Ecology's Quality System Components

- Laboratory Information Management System
- Environmental Information Management System (EIM)
- Lab Accreditation Database
- Other databases using info from EIM

Ecology Quality Docs

- *Air Monitoring Quality Assurance Plan*
- *Manchester Environmental Laboratory, Laboratory Quality Assurance Manual*
- *Manchester Environmental Laboratory, Lab Users Manual*
- *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*
- *Procedural Manual for the Environmental Laboratory Accreditation Program*

Ecology policy 1-21

- Establishing quality assurance (QA)
  - Policy applies to all Ecology employees, and to data collection activities conducted or funded by Ecology i.e. grant and loan activities that generate data
  - QA defined as “integrated program for assuring the reliability and quality of environmental data”
  - Internet site defines QA functionally -- i.e. “monitor and improve scientific practices”

Establishing QA

- QA Management Plan is the guiding document
- Plan is available on Ecology’s internet site
- http://www.ecy.wa.gov/programs/eap/qa/docs/policy_01-21.pdf

Establishing QA

- Responsibilities –
- QA Officer is designated by Department Director
- Program Managers designate program QA coordinators
- TCP, WQ and EAP also implementing Regional QA representatives

Establishing QA

- Quality Assurance Project Plans (QAPP)
- QAPP required for all data generating projects, including projects that Ecology funds
- QAPPs must be completed and approved before project begins
- Guidance is at --- http://www.ecy.wa.gov/biblio/0403030.html

What's in a QAPP

- Objectives of activity
- What data is needed to meet objectives
- Details logistics, sampling and schedule, methodology, quality control, data assessment
- Includes SOPs for process documentation
- QAPPs should be "right-sized", appropriate to the size and importance of the study

Policy 1-21 wrap-up

- QA Officer – additional responsibilities
- Provide technical assistance to Ecology on QA matters
- Coordinate QA training for the agency

Policy 1-22

- Requiring use of Accredited Environmental Labs
  - Policy applies to all Ecology staff
  - WAC 173-50; RCW 43.21A.230; RCW 43.21A.4
  - Lab Accreditation Unit responsible for accrediting labs

Use of accredited labs

- Ecology accredits labs and the analytical methods they perform
- Applicable data
  - Water, soil, sediment, sludge, air, plant and animal tissue, hazardous waste\
- Applicable analyses
  - Chemical, physical, biological, microbiological or other determinations that provide results from a lab context

Use of accredited labs

- Waiver policy
  - Waives use of accredited labs
  - Requires approval of QA officer, EAP program manager, or Deputy Director
  - Usually granted only if no accredited lab for a particular methodology.
  - Pharmaceuticals, personal care products
  - Microbial source tracing

Grant/Loan QAPP review policy

- QAPPs required for all G/L data generating activities
- Problems with QAPP development with grant/loan recipients
- Internal review policy developed
- QAPP review checklist developed for project managers
- Primary review then technical review

Credible Data Policy

- Required by the Water Quality Data Act, passed in 2004
- Sets up rigorous QA requirements for water quality data submitted to Ecology
- Applies to several CWA programs…
  - 303d listings (impaired waters0
  - Water quality standards
  - TMDL listings
- Chad Brown will discuss later

Ecology's Toxics Cleanup Program – EIM Policy

- Policy 840 -- TCP has internal policy for data submittal to EIM
- Applies to any permit, grant, loan, contract, inter-agency agreement, or memorandum of understanding where site-specific environmental monitoring data is expected to be generated

SOP Policy

- EAP Policy 1-08
- Establishes formatting and content requirements for all Program SOPs
- Available at…
- http://www.ecy.wa.gov/programs/eap/qa/docs/01-08%20SOPS.pdf

Summary

- Formal planning process (QAPP) required for all projects generating environmental data
- Applies to Ecology staff and contractors, CDs, cities, counties, all externals generating environmental data funded by ECY
- Not optional
- QAPP due six weeks before sampling

Summary

- EIM data submittal required for grants, loans, 303d data, TCP clean-up data
- Accredited labs required for most data submitted to Ecology
- SOPs required for all field activities

Resources

- Ecology's QA website -- http://www.ecy.wa.gov/programs/eap/quality.html
- QAPP Guidance -- http://www.ecy.wa.gov/pubs/0403030.pdf
- Quality Management Plan -- http://www.ecy.wa.gov/pubs/0503031.pdf
- EPA Quality Website -- http://www.epa.gov/quality/

Ecology's LIMS

- Laboratory Info Mgt. System
- Live in 1995
- Homegrown
- ORACLE-based
- Integrated with EIM System
- Most data remains in the digital domain
- Looking for COTS SQL Server replacement

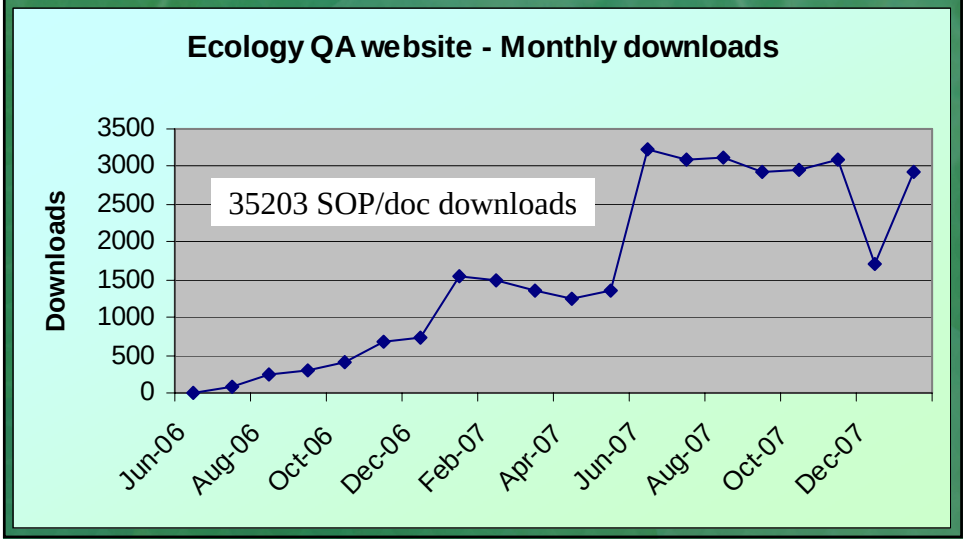
LIMS continued

- Total records – 8.5 million
- Projects – 12,233
- Results – total: 2.35 million
- Results – sample: 1.55 million
- Database size – 70 GB
- Numbers do not include "active" projects

Ecology quality system

- QA internet site
- One stop shopping for Ecology QA policies, SOPs, and other QA documents
- QAPP development tool resides here
- 3000 document downloads/month
- 34 Ecology SOPs currently posted

Ecology QA website activity

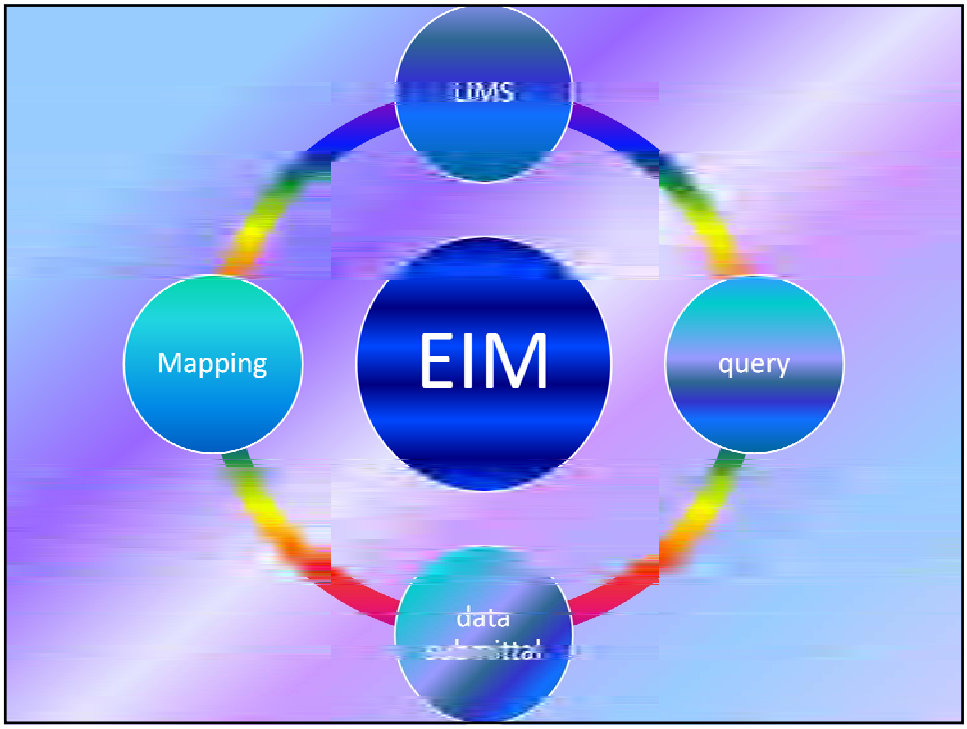


Lab Accreditation database

- Live in ’05
- Accreditation database
- Lab query

Next up

- Chris Neumiller on our Environmental Information Management system (EIM)


LIMS
Mapping
EIM
query
data

Environmental Information Management System

April 2008

Chris Neumiller
WA State Department of Ecology

What is EIM?

- Ecology's main environmental monitoring database
- Physical, chemical, and biological monitoring records
- Supplementary information:
  - Study, contact info
  - Monitoring location and well details
  - Methods, labs, data quality, data originator etc...

What Data Goes into EIM?

Environmental monitoring data indicating condition of Washington's air, land, & water

Data Sources

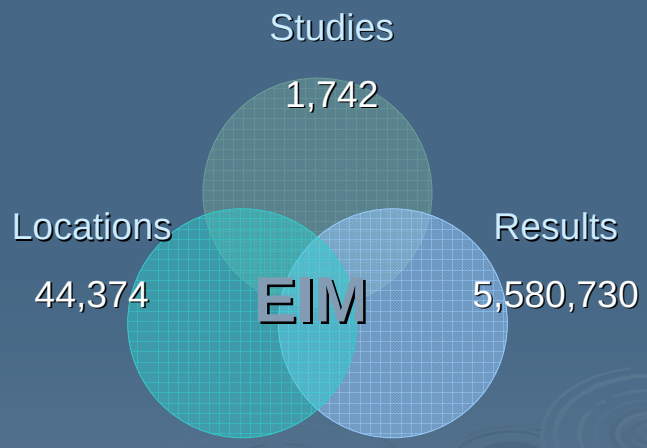
Ecology

- Lab and Field

External

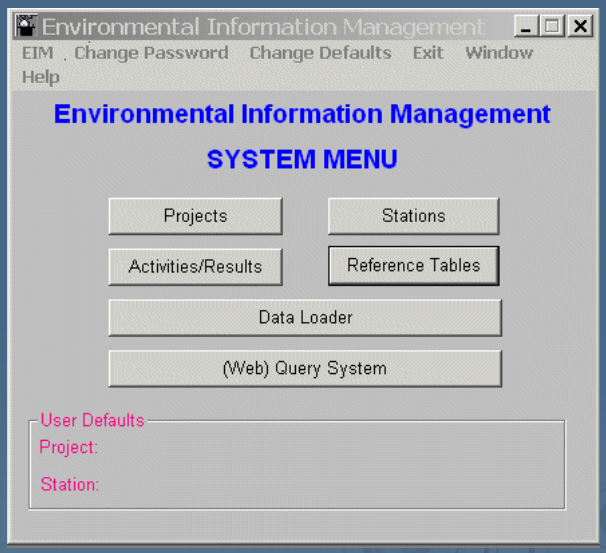
- Affiliate
- Grantee
- Cleanup
- Sediments
- 303(d)

EIM Structure



Records as of 3/14/2008

Early Years



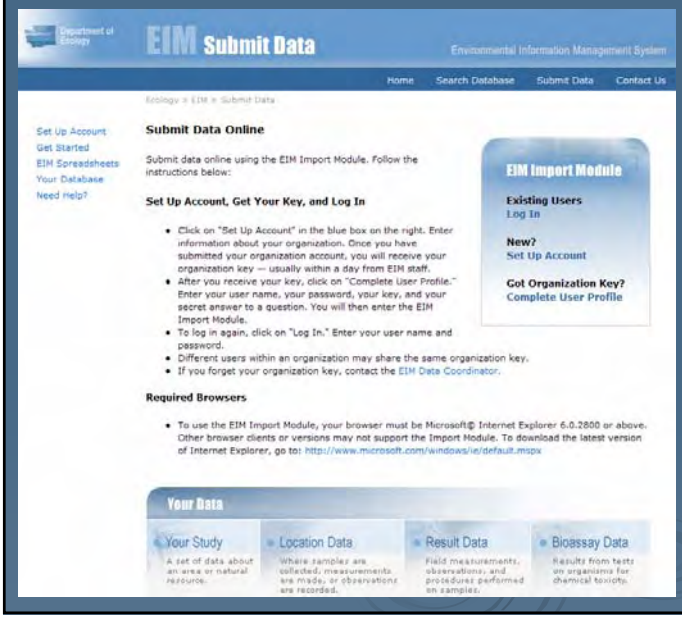
- 1997 launch
- Older technology
- Limited reporting
- No public access

Progress

- 2001 - Online access
- 2003 - Map search
- 2004 - Online data submittal
- 2007 – Advanced search/analysis

URL: http://www.ecy.wa.gov/eim

Submitting Data



- Online
- Common format
- Less "bad" data
- Reduced workload for Ecology

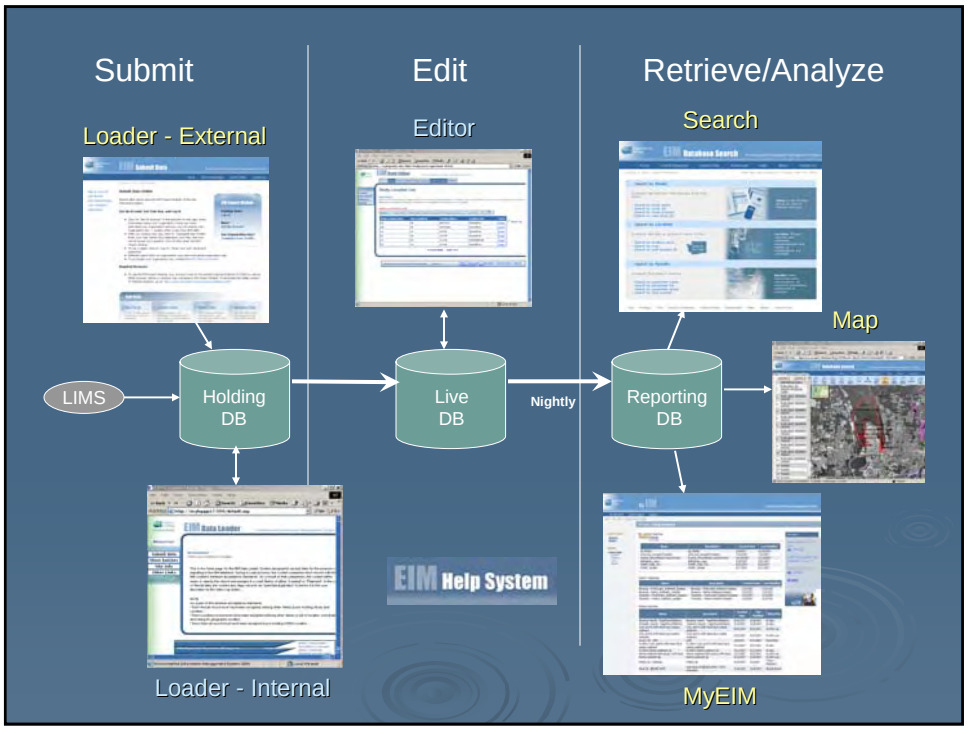
Retrieving Data

- Tabular and Map Search
- Sort
- Details
- Download
- Links to Well Logs and Reports

URL: http://www.ecy.wa.gov/eim

Analyzing Data

- MyEIM
- Custom Search
- Analytical Tools



Ecology Homepage – EIM Links

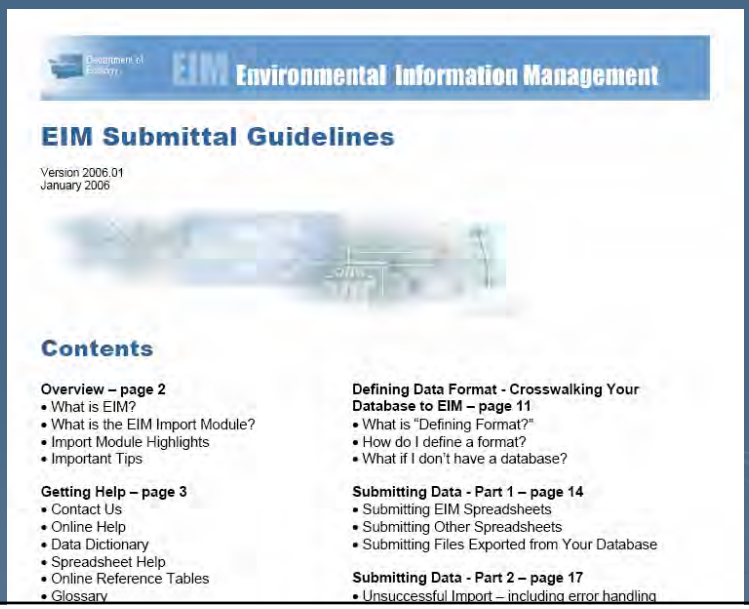
EIM Homepage

URL: http://www.ecy.wa.gov/eim

EIM Data Coordinators
Crucial Role!

- Help users with data submittal
- QA and load data
- Coordinate with stakeholders
- Front-line users of/advocates for EIM

External Data Submittal – Guidelines



Environmental Information Management

EIM Submittal Guidelines

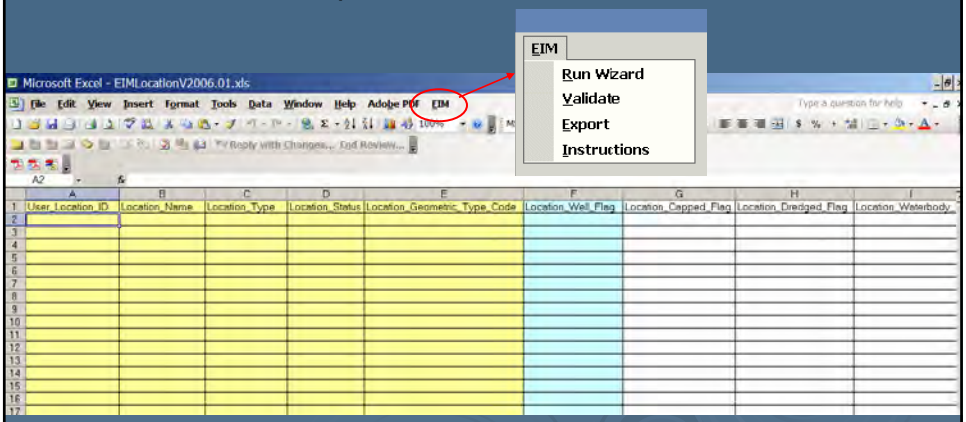
Version 2006.01
January 2006

Contents

URL: http://www.ecy.wa.gov/eim

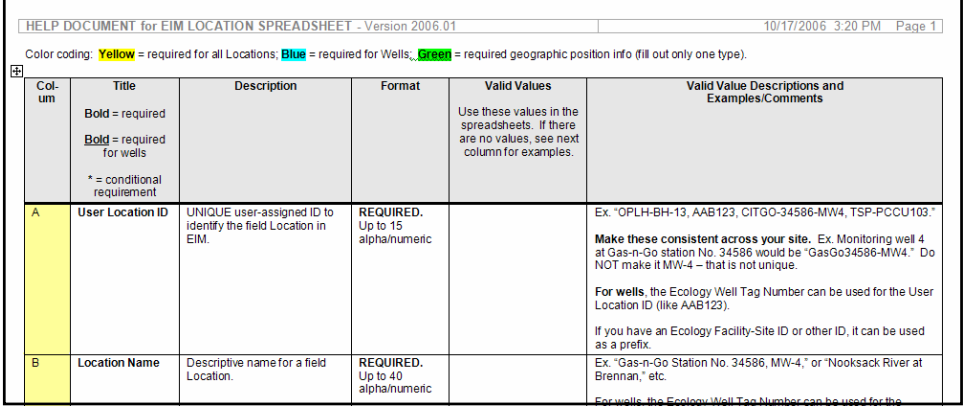
Data Submittal – Spreadsheets

- For Location and Results Data
- Use accompanying help documents to fill these out
- EIM Menu has special functions



Data Submittal – Spreadsheet Help

- For Study, Location and Results Data
- Required fields, descriptions, valid values, examples
- Color-coded to spreadsheets, formatted for printing



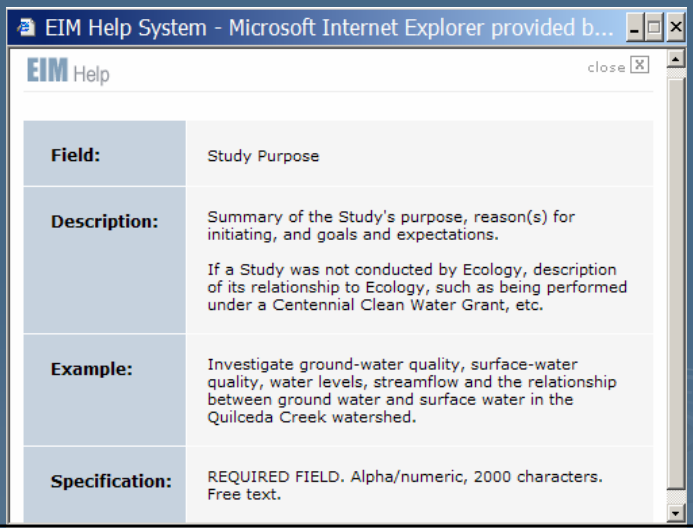
HELP DOCUMENT for EIM LOCATION SPREADSHEET - Version 2006.01 10/17/2006 3:20 PM Page 1

Color coding: Yellow = required for all Locations; Blue = required for Wells; Green = required geographic position info (fill out only one type).

Col-um	Title Bold = required Bold = required for wells * = conditional requirement	Description	Format	Valid Values Use these values in the spreadsheets. If there are no values, see next column for examples.	Valid Value Descriptions and Examples/Comments
A	**User Location ID**	UNIQUE user-assigned ID to identify the field Location in EIM.	**REQUIRED.** Up to 15 alpha/numeric		Ex. "OPLH-BH-13, AAB123, CITGO-34586-MW4, TSP-PCCU103." **Make these consistent across your site.** Ex. Monitoring well 4 at Gas-n-Go station No. 34586 would be "GasGo34586-MW4." Do NOT make it MW-4 – that is not unique. **For wells**, the Ecology Well Tag Number can be used for the User Location ID (like AAB123). If you have an Ecology Facility-Site ID or other ID, it can be used as a prefix.
B	**Location Name**	Descriptive name for a field Location.	**REQUIRED.** Up to 40 alpha/numeric		Ex. "Gas-n-Go Station No. 34586, MW-4," or "Nooksack River at Brennan," etc. For wells, the Ecology Well Tag Number can be used for the

Data Submittal – Online Help

- Click any field label for pop-up help
- Works in any part of EIM – internal and external



Data Submittal – Focused Help

EIM Data Entry Help Documents

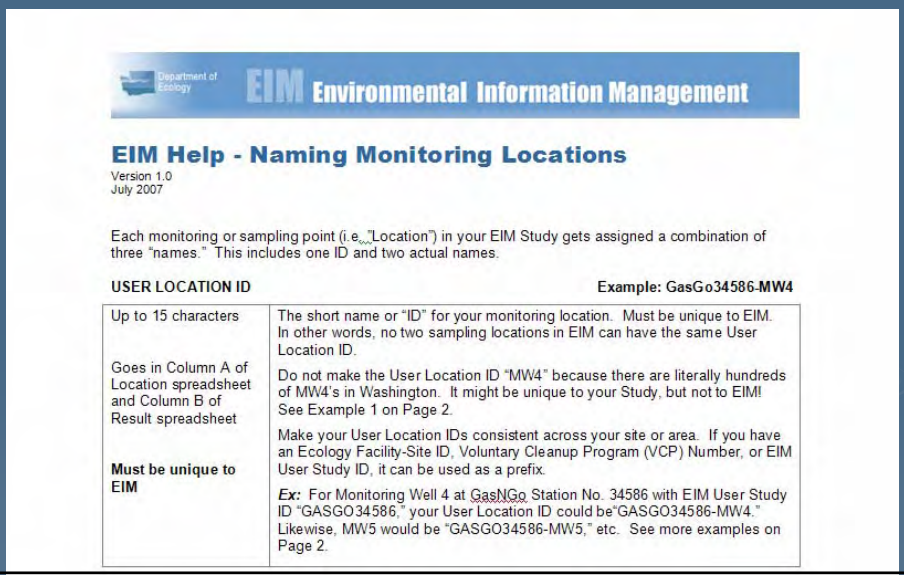
Locations

- **Lat/Long List Builder Instructions**
  Use EIM map to get coordinates for your field locations
- **Naming Monitoring Locations**
  Tips on naming conventions for wells and other field locations

Results

- **Data Types Not Entered into EIM**
- **Entering Field Replicates**
- **Entering Lab Dilutions and Re-Extractions**
- **Entering Pit Water Data**
  Water from excavations or trenches
- **Entering TCLP Data**
  Toxicity Characteristic Leaching Procedure
- **Measurement Basis**
  Dry weight, wet weight, etc.
- **Sample Fraction**
  Total, dissolved, etc.

Data Submittal – Focused Help



Department of Ecology **EIM** Environmental Information Management

EIM Help - Naming Monitoring Locations

Version 1.0
July 2007

Each monitoring or sampling point (i.e., "Location") in your EIM Study gets assigned a combination of three "names." This includes one ID and two actual names.

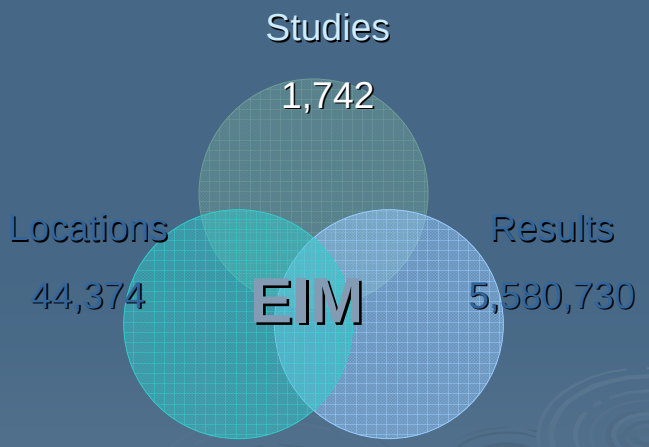
USER LOCATION ID **Example: GasGo34586-MW4**

Up to 15 characters Goes in Column A of Location spreadsheet and Column B of Result spreadsheet **Must be unique to EIM**	The short name or "ID" for your monitoring location. Must be unique to EIM. In other words, no two sampling locations in EIM can have the same User Location ID. Do not make the User Location ID "MW4" because there are literally hundreds of MW4's in Washington. It might be unique to your Study, but not to EIM! See Example 1 on Page 2. Make your User Location IDs consistent across your site or area. If you have an Ecology Facility-Site ID, Voluntary Cleanup Program (VCP) Number, or EIM User Study ID, it can be used as a prefix. ***Ex:*** For Monitoring Well 4 at GasNGo Station No. 34586 with EIM User Study ID "GASGO34586," your User Location ID could be"GASGO34586-MW4." Likewise, MW5 would be "GASGO34586-MW5," etc. See more examples on Page 2.

QA on Data Submittals

- Required elements and valid values enforced by the system
- Business rules and data acceptance protocols for QA'ing and entering data

EIM Structure - Study



Records as of 3/14/2008

Key Study Elements

- User Study ID
- Name
- Status
- Purpose
- Type (Contaminated site investigation, BMP, etc.)
- QA Planning Level
- QA Assessment Level
- Start and End Date
- Responsible Entity
- Ecology Lead/Contact
- Study Area Name
- Result Description
- Study Bibliography

QA at Study Level
Planning

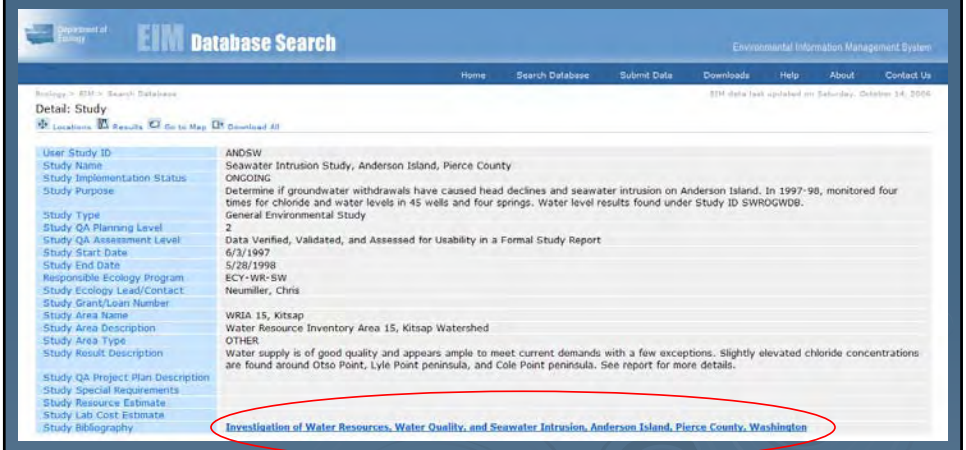
- Level l - Informal or no QA documentation
- Level 2 - Generic or incomplete document
- Level 3 – QAPP, SAP or Equivalent
- Level 4 - Approved QAPP or SAP

QA at Study Level
Overall QA

- Level 1 - Data not Verified or Assessed for Usability
- Level 2 - Data Verified
- Level 3 - Data Verified and Assessed for Usability
- Level 4 - Data Verified and Assessed for Usability in a Formal Study Report
- Level 5 - Data Verified and Assessed for Usability in a Peer-Reviewed Study Report

Study Detail

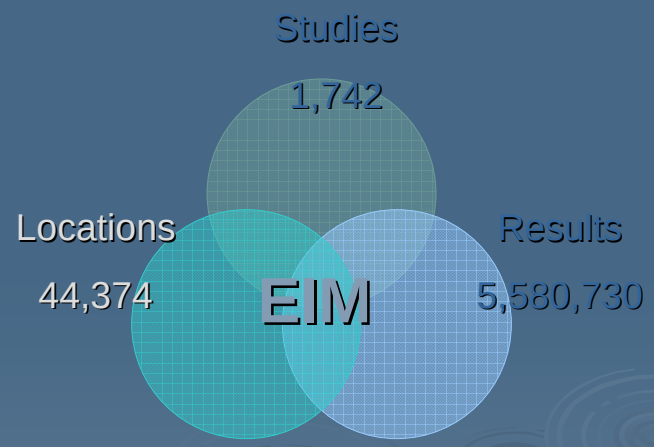
How it looks after it's entered



Link to Report

Link to Report

EIM Structure - Location



Records as of 3/14/2008

Key Location Elements

- User Location ID
- Name
- Address, City, State, Zip
- Well Flag
- Geometric Type (P, L, A)
- Type (Stream/River, Land, etc.)
- Description
- Waterbody ID and Index Number
- Coordinate System (decimal or deg-min-sec Lat/Long, SPCS, UTM)
- Horizontal/Vertical Datum, Reference Point, Accuracy, Collection Method
- EIM calculates Lat/Long in NAD83 HARN and Elevation but preserves original coordinates

Key Well Elements

- Well Tag Number
- Owner Name (internal only)
- Use (Monitor, etc.)
- Water Use (Irrigation, etc.)
- Wellhead Protection Area
- Construction Method
- Development Method
- Completion Depth
- Construction End Date
- Completion Type
- Status (Active, Abandoned)
- Maximum Casing Diameter
- Construction Comment
- Measuring Point

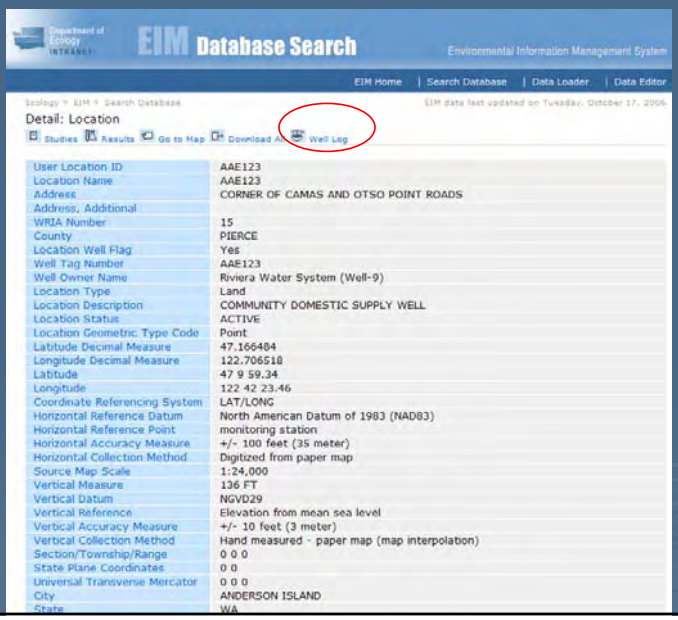
Collecting Field Coordinates

- Not acceptable to lump all sampling points into one coordinate
- Must submit individual coordinates for each sampling point or well
- Sampling areas permitted in some circumstances

Collecting Field Coordinates
Tools

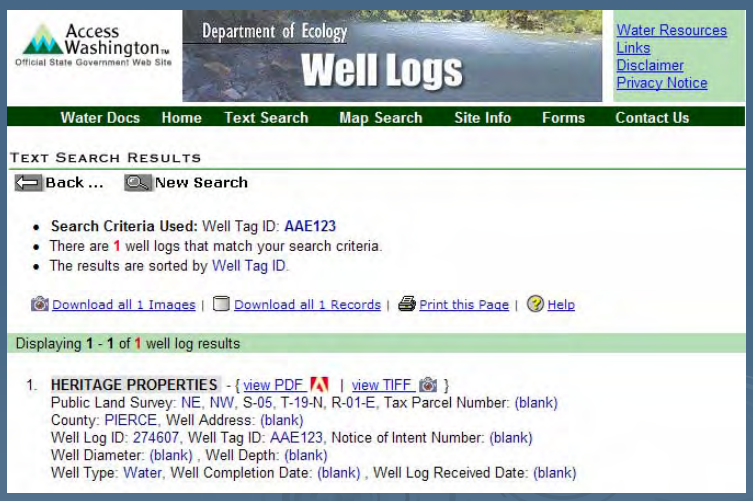
- GPS - Set/denote DATUM (NAD83, etc)
- Prof. Survey - Tie into major DATUM
- EIM Map - Lat/Long List Builder

EIM Location Detail
How it looks after it's entered

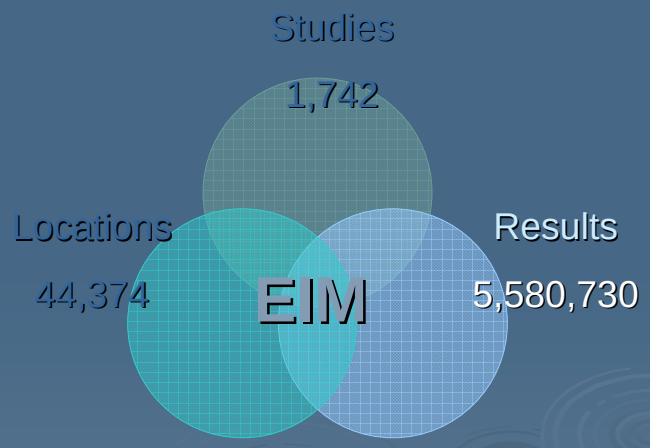


User Location ID	AAE123
Location Name	AAE123
Address	CORNER OF CAMAS AND OTSO POINT ROADS
Address, Additional	
WRIA Number	15
County	PIERCE
Location Well Flag	Yes
Well Tag Number	AAE123
Well Owner Name	Riviera Water System (Well-9)
Location Type	Land
Location Description	COMMUNITY DOMESTIC SUPPLY WELL
Location Status	ACTIVE
Location Geometric Type Code	Point
Latitude Decimal Measure	47.166484
Longitude Decimal Measure	122.706518
Latitude	47 9 59.34
Longitude	122 42 23.46
Coordinate Referencing System	LAT/LONG
Horizontal Reference Datum	North American Datum of 1983 (NAD83)
Horizontal Reference Point	monitoring station
Horizontal Accuracy Measure	+/- 100 feet (35 meter)
Horizontal Collection Method	Digitized from paper map
Source Map Scale	1:24,000
Vertical Measure	136 FT
Vertical Datum	NGVD29
Vertical Reference	Elevation from mean sea level
Vertical Accuracy Measure	+/- 10 feet (3 meter)
Vertical Collection Method	Hand measured - paper map (map interpolation)
Section/Township/Range	0 0 0
State Plane Coordinates	0 0
Universal Transverse Mercator	0 0 0
City	ANDERSON ISLAND
State	WA

Link to Well Logs
by Well Tag Number



EIM Structure - Results



Records as of 3/14/2008

Key Result Elements

- Field Activity - what took place in the field
- Sample - information about a sample – how it was collected or processed, etc.
- Result - details about the outcome of a measurement or analysis

Field Activity Elements

- Type
- Data Originator
- Date/Time
- Comment
- Reference Point (land surface, etc.)
- Depth
- Well Measuring Point (for water levels)

Key Sample Elements

- ID, Field Replicate ID, etc.
- Replicate, Composite Flags
- Matrix, Source
- Chain of Custody
- Sample Method (collection, etc.)
- Lab Name
- Taxon Name, TSN
- Tissue Type, Resection Date, ID
- Trawl Length, UOM, Duration

Key Result Elements

- Parameter Name, CAS Number
- Date, Time, Accuracy
- Reported Value, UOM
- Reported PQL Value
- Data Qualifier (U, J, etc)
- Sample Fraction (total, dissolved, etc.)
- Measurement Basis (dry, wet)
- Quality
- Result Method
- Comment
- Lab Replicate ID (DIL2, REX1)
- Lab Name
- Validation Method
- Taxon Name, TSN
- Taxon Life Stage, Distribution, Pathology, Severity

QA at Result Level

- Result Data Qualifier
  - Usually assigned by lab or data verifier
  - EIM has 30+, like U (ND) and J (estimate)
  - Must translate your qualifiers to EIM's
- Result Quality
  - "MA" codes indicating method quality
  - "WL" codes for water level accuracy

QA at Result Level, cont.

- Result Reported PQL Value
  - "Practical Quantitation Limit"
  - Put reporting limit here
- Result Validation Method
  - Validation method used for result data
  - Like "Lab-generated duplicates"

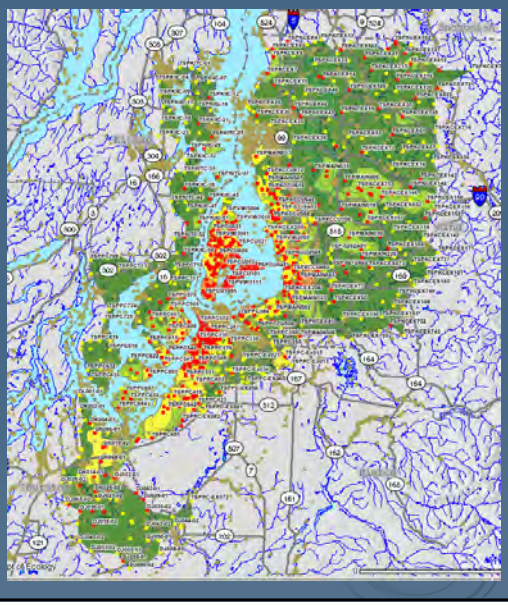
QA-Related Elements

- National Standards to Extent Possible
  - Environmental Information Exchange Network
- Reference Tables – Single Gatekeeper
  - Parameters - EPA SRS Substance Registry System
  - Methods - NEMI National Environmental Methods Index
  - Taxonomy - ITIS Integrated Taxonomic Information System

QA Oversight – Business Side

- Steering Committee
  - Upper-level agency-wide decisions
- Data Coordinators
  - Lead coordinator, Program coordinators
  - Data acceptance protocols, business rule enforcement
  - User help and training
- User's Group
  - Discuss issues in agency-wide forum
  - Business rule development

Use of Data



- Tacoma Smelter Plume arsenic distribution
- Data collected by
  - King, Pierce, Kitsap and Thurston Counties
  - Department of Ecology

External Data Users

- Pacific Northwest Water Quality Data Exchange
- WA Depts. of Health and Agriculture
- Former SEDQUAL users - USACE, NOAA, etc.
- Tacoma Smelter Plume data repository
- Counties, Local Health Depts.
- Consultants

Current & Future Projects

- Dataflows to EPA STORET and BEACHES systems
- Continuous Monitoring and Habitat Data
- More system integration – Facilities database, etc.

Visit EIM at: http://www.ecy.wa.gov/eim

URL: http://www.ecy.wa.gov/eim