WHITE PAPER

Best Practices for Incorporating Spatial and Temporal Data Into Non-Spatial Databases:

Tracking Environmental Project and Sampling Efforts

Draft Version 1.0.5

Acknowledgements

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Much of the physical data structure outlined in this document is based on work that Joy Paulus conducted at the WA State Department of Ecology on the Environmental Information Management System back in 2000.

Introduction and Background

In the Pacific Northwest there are hundreds of research, monitoring and evaluation and environmental management projects creating substantial quantities of data. Most of this data has spatial and temporal data elements that are often reported using different standards and formats.

There is a region-wide need, for multiple purposes, to be able to view and analyze this data at different landscape-scales. This requires the creation of integrated data products (maps, tables, charts, statistical analyses) from multiple data sets. Unfortunately, because the data has been reported without common standards, the data integration task is time-consuming and expensive. And, because data transformation is needed, errors are introduced. In many instances the burden of data integration and error checking prevents data analysis.

Why Use Data Standards

A minimum set of mapping standards is necessary to ensure the successful implementation of multi-agency approach to data collection. Consistent use of common reporting standards would have significant benefits to the region:

- Reducing errors and improving product quality;
- Leveraging existing technical advances and investments that have been made in spatial and temporal data collecting and viewing. In particular: Geographic Positioning Systems for determining location (and time) and Geographic Information Systems for creating spatial products;
- Reducing the cost of analysis and increasing confidence in analytical products;
- Allowing easier and more widespread use of data collected across different programs and entities;
- Increasing data stability;
- Improved data maintenance over time; and
- Increased understanding of the information content.

The use of consistent minimum spatial and temporal data reporting standards are not a technical challenge: it is a policy choice. It requires action within agencies to support or require the use of consistent standards within relevant agency projects and programs.

Coordination Between Data Standards Work Groups

Coordination between various standards work groups is crucial. Collaboration ensures that past and present data collection efforts are leveraged to their fullest extent. Benefits of this approach are:

- Avoidance of duplicate efforts;
- Identification of gaps in standards development efforts; and,
- The building and sharing of a common knowledge base.

Intended Users of These Guidelines

These guidelines are geared toward data collectors that are not presently tracking environmental project data within a geographic information system (GIS). This is focused on data collectors who are managing their monitoring information with a database or spreadsheet.

Organizations that are already employing GIS systems to help track monitoring and restoration projects are encouraged to track similar elements using established state and federal data and metadata standards. Example of more detailed federal standards can be found at:

- EPA (for detailed geolocational standards) http://iaspub.epa.gov/edr/epastd$.startup
- FGDC (for metadata):http://www.fgdc.gov/standards/standards.html

Nothing in these guidelines is intended to diminish existing authorities for information collection or reporting. For example most Federal entities are already required to provide FGDC compliant metadata about spatial, temporal and other data collection efforts.

Acquiring Latitude and Longitude Coordinates for Your Projects

The following sources of coordinate information may help to make reporting information about your project area easier. This material is not intended to be a complete guide for working with GIS or GPS, but rather, a guide for building the needed attributes in a database system so you can track project information at the simplest level.

Hardcopy Maps Sources

- USGS quad sheet have lat/long coordinates grid along the side of the map

Map Data for Your Computer

- National Geographic sells USGS quad data on CD/DVD's for individual states that can be loaded on your PC

Free On-line Map Sources

There are on-line USGS maps that can be accessed on line from different sources: for example from Topozone http://www.topozone.com or from MapTech's http://www.maptech.com/

These sites allow you to search for your area of interest and then displays the area selected. By holding your mouse over a point on the map it will display the lat/long coordinates of that point.

Web Mapping Services

- For organizations that need access to frequent and accurate geocoding information there are services that can provide you with this sort of service. One example is ArcWeb Services for Geocoding.
  http://esri.com/software/arcwebservices/index.html

How to Understand and Use the "Multi-Level" Guidelines

These guidelines were designed with flexibility in mind. Since some projects are simpler than others the **"Multi-Level"** structure allows project managers to track projects and location information at the appropriate level of detail. See Table 1 for descriptions of Level 1, Level 2 and Level 3.

Simple projects can typically be tracked using **Level 1,** which provides managers and end users with just enough general information like project name, sponsor, project type, along with a general physical description of the projects location and its duration.

But, as we know, certain projects can become complex, especially when they entail specific sampling or other activities. In these instances, a project can cover a large area with discrete places where information is tracked and collected, for example, about culvert replacements at multiple sites. In this case you could track project information at **Level 1** and **Level 2**.

Level 2 provides for a more detailed collection of data than **Level 1**. In some cases, tracking information at **Level 2** isn't even sufficient. During some projects, sites could be visited many times and could also sample a number of different elements at each of the sites. Project Sites where water chemistry and a stream's morphology are collected along different reach segments is an example of when **Level 3** information would be needed. With this complexity you would be tracking project information at all three levels.

It's for this reason that this "*leveled"* structure for tracking project location and duration was created. This way, you can record information on simple to complex projects as the need arises.

Using the Spatial and Temporal Tables

The following Tables are broken down into their separate, essential elements and are meant as a guide for information managers. In order to attain consistency across regional organizations, the actual element (logical) names and element definitions should be adopted "as is" along with the code tables listed under "*Element Codes*". But, the physical attribute names themselves are only provided as guidance. Your own agency data naming conventions may need to be followed. The more consistency you use in implementing these standards, the better we'll all be able to link information together. Note, as you define your naming standards you will also need to define the business rules for how you will represent project, site and feature location.: For example if you wish to characterize a watershed with a single point you could define that point as the centroid for the watershed. Similarly if you are defining a single point for a fence you could define that point as the mid point of the fence.

Table 1: Project Level Summary Table (Levels 1-3)
Provides the user with a quick overview of the "multi-level" data approach and the associated definitions and data elements. It also provides an outline of the types of other project information that you might what to consider collecting. The **bolded** headings represent the spatial and temporal elements that we suggest should be added to existing and new project tracking systems. The project level summary table information does not require the user to provide elevation related data. This data can be generated if the user needs it and therefore it is not essential to report it separately.

Table 2: Spatial and Temporal Data Elements Associated with Projects (Level 1)
Provides detailed information about the types of spatial and temporal information that should be associated with all general projects. It also provides information on the following data elements – the name, its definition, an example of a database name, the associated codes to track the information properly along with examples. The **bolded** headings represent the spatial and temporal elements that we suggest should be added to existing and new project tracking systems. The Spatial and Temporal table information does not require the user to provide elevation related data. This data can be generated if the user needs it and therefore it is not essential to report it separately.

Table 3: Spatial and Temporal Data Elements Associated with Project Sites (Level 2)
Provides the user with an overview of how you would implement the spatial and temporal information in a more complex project. Projects where you are tracking specific and or numerous locations or where the projects sites exist over time. Not all projects with have this of detail or the information may not be available for reporting. Following this format will enable the reporting of more detailed information concerning actual activities that are being performed in the field.

The Table also provides information regarding the project site and its associated spatial and temporal elements. You will also find examples of database attributes and their

associated code tables. The **bolded** headings represent the spatial and temporal elements that we suggest should be added to existing and new project tracking systems. The spatial and temporal data elements table information does not require the user to provide elevation related data. This data can be generated if the user needs it and therefore it is not essential to report it separately.

The Table also provides information regarding the project site and its associated spatial and temporal elements. You will also find examples of database attributes and their associated code tables. The **bolded** headings represent the spatial and temporal elements that we suggest should be added to existing and new project tracking systems. The spatial and temporal data elements table information does not require the user to provide elevation related data. This data can be generated if the user needs it and therefore it is not essential to report it separately.

Table 4: Spatial and Temporal Data Elements Associated with Project Site Features (Level 3)
Provides the user with an overview of how you would implement the spatial and temporal information in a more complex project which require the project manager to track specifically measured features in the field at a given project sites. Again, not all projects will need to be tracked at this of detail. The table outlines the spatial and temporal elements of site features. You will find examples of database attributes and their associated code tables and examples of how this would be applied in the field. The **bolded** headings represent the spatial and temporal elements that we suggest should be added to existing and new project tracking systems.

Table 5: Optional Elevation Data Elements Associated with Projects Sites or Features
Table 5 provides the user with an option of reporting elevations for Projects, Sites or Features. Elevation is not included as essential reporting elements because elevations they can usually be derived from other sources.

Table 6: Examples of Spatial and Temporal Data Reporting for Different Types of Data Collection Efforts
Provides the user with examples of how features can be reported at different levels of spatial and temporal detail, depending on the sophistication of whether the data is a "independent" or "corporate" data collector. A narrative, following Table 5, provides detailed descriptions of how data collectors with different levels of GIS support could use the standards.

Table 1: **Project Level Summary Overview Table**

	Project Tracking Example	Minimum Spatial Elements	Minimum Temporal Elements
Level 1	***Project Definition:*** *A project is an administrative unit or work area that's defined by an organization or entity.* *PROJECT* = one project present per grant/activity/etc	<u>Project Guideline</u> Project ID (unique system identifier) PK Project Name (user defined name) Project Type **Project Location Description** (physical place where project collection/measurement/observation occurred) **Project Location** (Longitude/Latitude in decimal degrees. The minimum reporting standard is a single point **Datum** (horizontal reference model) **Project Location Collection Method** (GPS, DEM, map derived, etc.)	<u>Project Guideline</u> **Project Start Date** (date the project started) 01/23/1998 **Project End Date** (date the project ended) 05/31/2005
Level 2	***Site Definition:*** *The location of a place where work is done in support of a project.* *SITE* = one or many sites may be contained in a project	<u>Site Guideline</u> Site ID (unique system identifier) PK Project ID Site Name (user defined name) Site Type **Site Location Description** (physical place where collection/measurement/observation occurred) **Site Location** (Longitude/Latitude in decimal degrees) The minimum reporting standard is a single point. **Datum** (horizontal reference model) **Site Location Collection Method** (GPS, DEM, map derived, etc.)	<u>Site Guideline</u> **Site Start Date** (date the site collection, measurement, observation started) 01/23/1998 **Site End Date** (date the site collection, measurement, observation ended) 05/31/2005
Level 3	***Feature Definition:*** *Things that are tracked at a specific site where work is conducted in support of a project.* *FEATURE* = one or many features may be present at a site	<u>Feature Guideline</u> Feature ID (unique system identifier) PK Feature Type (fence, transect, planting area, etc.) **Feature Location Description** (physical place where collection/measurement/observation occurred) **Feature Location** (Longitude/Latitude in decimal degrees) The minimum reporting standard is a single point. **Datum** (horizontal reference model) **Feature Location Collection Method** (GPS, DEM, map derived, etc.)	<u>Feature Guideline</u> **Feature Start Date** (date the collection, measurement, observation started at this site) 01/23/1998 **Feature End Date** (date the collection, measurement, observation ended at this site) 05/31/2005 **Feature Start Time** (time the collection, measurement, observation started -using a 24hr clock at local time) (hhmmss) e.g. 164322 **Feature End Time** (time the collection, measurement, observation ended -using a 24hr clock at local time) (hhmmss) e.g. 175231

***Table 2*: Spatial and Temporal Data Elements Associated with Projects**

Level 1 General Project Tracking Information			
Logical Name	**Element Definition**	**Physical Name (For Example Only)**	**Element Code or Code Range**
Project	A project is a unit of work defined by an organization or entity. A project may include one or more sites or one or more types and number of activities.		Examples ▪ Skagit River Habitat Restoration Project ▪ Okanogan Water Quality Sampling Project ▪ Oregon North Coast Nearshore Monitoring Project ▪ Deschutes River Flow Monitoring Project
Project Location Description	Term that best describes the field location in relation to the surrounding environment. Information that describes the place a Location exists.	(PRJ_LOC_DESC)	Text field Examples: ▪ Okanogan watershed ▪ ESA Region ▪ SW ¼ of Section 36 of Township 29 Range 01
Project Location Latitude Coordinate	Distance north or south of the equator. Decimal equivalent to the degrees-minutes-seconds latitude value.	PRJ_LOC_LAT_COORD	Float, 3 places, 6 decimals; Range for WA: 45.000000-49.999999
Project Location Longitude Coordinate	Distance east or west of the Central Meridian (Greenwich, England). Decimal equivalent to the degrees-minutes-seconds longitude value	PRJ_LOC_LONG_COORD	Float, 3 places, 6 Decimals, will accommodate signed values; E.g. Range for WA: -116.000000 – -125.999999
Project Horizontal Datum	Model used to match the horizontal position of features on the ground to coordinates and locations on a map. NOTE - When taking GPS measurements, it is very important to	PRJ_HORZ_DAT	01 - N. American Datum 1927 (NAD27- used on many USGS quad maps or NOAA charts); 02 - N. American Datum 1983 (NAD83 or 91 Adj. – based on Earth and satellite observations, similar to WGS84 but

	record your datum!		specific to North America.); 03 - High Accuracy Reference Network (HARN – similar to NAD83, but more accurate per GPS observations); 04 - World Geodetic System of 1984 (WGS84 – world datum, based on Earth and satellite observations); 99 - unknown.
Project Location Collection Method	Technique used to collect the horizontal coordinates of a Location.	PRJ_LOC_COLL_MTH	1 - Address Matching - Block Face; 2 - Address Matching - House Number; 3 - Address Matching - Street Centerline; 4 - Address Matching - Unknown; 5 - Aerial Photography - Rectified; 6 - Aerial Photography - Unknown; 7 - Aerial Photography - Unrectified; 8 - Cadastral Survey (conventional land survey); 9 - Census Block 1990 Centroid; 10 - Census Block Group 1990 Centroid; 11 - Conversion from STR; 12 - Digital or manual raw photo extraction; 13 - Digitized off CTR screen/digitial data; 14 - Digitized - paper map; 15 - GPS carrier phase (employs the satellite Code's carrier signal to improve accuracy); 16 - GPS code phase (measurements based on pseudo random code broadcast by satellite); 17 - GPS kinematic (tracking location while moving using carrier

			phase); 18 - GPS (Unknown); 19 - Hand measured - paper map (interpolation); 20 - LORAN-C; 21 - Orthophotography - digital; 22 - Orthophotography - paper; 23 - Satellite Imagery - Landsat MSS (Multi-Spectral Scanning); 24 - Satellite Imagery - Landsat TM (Thematic Mapper); 25 - Satellite Imagery - Other; 26 - Satellite Imagery - SPOT Panchromatic; 27 - Satellite Imagery - SPOT Multi Spectral; 28 - Zip Code Centroid; 29 - GPS (Code/Differential); 30 – Estimated Value 99 - unknown
Project Start Date	The date that the project activity commenced.		Date, MM/DD/YYYY format. A date of 1/1/1900 indicates that a Field Activity Start Date is not specified or is unknown.
Project End Date	The date that the project activity ended.		Date, MM/DD/YYYY format. 03/12/2003

***Table 3*: Spatial and Temporal Data Elements Associated with Project Sites**

Level 2 **The Following Elements Are Nested Under Projects** **(This of detail may not be necessary for all reporting purposes)**			
Logical Name	**Element Definition**	**Physical Name (For Example Only)**	**Element Code or Code Range**
Project Site	The place where site activities that are associated with a project occur or the area where the work is done. Each site will pertain to just one project but there can be more than one site for any given project. Location of the site or activities where work is conducted - on the ground activities		*This need to be defined based on the type of project site work that is being done* ▪ *Skagit River Habitat Restoration Sites- 2 stream reaches* ▪ *Okanogan Water Quality Sampling Site – 4 monitoring sites in study* ▪ *Oregon North Coast Nearshore Monitoring Sites- 3 coastal reaches in project* ▪ *Deschutes Flow Monitoring Sites – 2 gauging stations in project*
Project Site Location Description	Term that best describes the site location in relation to the surrounding environment. Information that describes the place a Location exists.	PRJ_SITE_LOC_DESC	Text field Example: ▪ 200 yards north of the cattle crossing on Laumann Road, north of the intersection with Heidi Road
Project Site Location	Distance north or south of the	PRJ_SITE_LOC_LAT_COORD	Float, 3 places, 6 decimals; Range for

Latitude Coordinate	equator. Decimal equivalent to the degrees-minutes-seconds latitude value.		WA: 45.000000-49.999999
Project Site Location Longitude Coordinate	Distance east or west of the Central Meridian (Greenwich, England). Decimal equivalent to the degrees-minutes-seconds longitude value.	PRJ_SITE_LOC_LONG_COORD	Float, 3 places, 6 decimals; will accommodate signed values; Range for WA: -116.000000 – -125.999999
Project Site Horizontal Datum	Model used to match the horizontal Position of features on the ground to coordinates and locations on a map. NOTE - When taking GPS measurements, it is very important to record your datum!	PRJ_SITE_HORZ_DAT	01 - N. American Datum 1927 (NAD27- used on many USGS quad maps or NOAA charts); 02 - N. American Datum 1983 (NAD83 or 91 Adj. – based on Earth and satellite observations, similar to WGS84 but specific to North America.); 03 - High Accuracy Reference Network (HARN – similar to NAD83, but more accurate per GPS observations); 04 - World Geodetic System of 1984 (WGS84 – world datum, based on Earth and satellite observations); 99 - unknown.
Project Site Location Spatial Data Collection Method	Technique used to collect the horizontal coordinates of a site location.	PRJ_SITE_LOC_COLL_MTH	1 - Address Matching - Block Face; 2 - Address Matching - House Number; 3 - Address Matching - Street Centerline; 4 - Address Matching - Unknown; 5 - Aerial

			Photography - Rectified; 6 - Aerial Photography - Unknown; 7 - Aerial Photography - Unrectified; 8 - Cadastral Survey (conventional land survey); 9 - Census Block 1990 Centroid; 10 - Census Block Group 1990 Centroid; 11 - Conversion from STR; 12 - Digital or manual raw photo extraction; 13 - Digitized off CTR screen/digitial data; 14 - Digitized - paper map; 15 - GPS carrier phase (employs the satellite code's carrier signal to improve accuracy); 16 - GPS code phase (measurements based on pseudo random code broadcast by satellite); 17 - GPS kinematic (tracking location while moving using carrier phase); 18 - GPS (Unknown); 19 - Hand measured - paper map (interpolation); 20 - LORAN-C; 21 - Orthophotography - digital; 22 - Orthophotography - paper; 23 - Satellite Imagery - Landsat MSS (Multi-Spectral Scanning); 24 - Satellite Imagery - Landsat TM

			(Thematic Mapper); 25 - Satellite Imagery - Other; 26 - Satellite Imagery - SPOT Panchromatic; 27 - Satellite Imagery - SPOT Multi Spectral; 28 - Zip Code Centroid; 29 - GPS (Code/Differential); 30 – Estimated Value 99 - unknown
Project Site Start Date	The date that the site activity (sample collection, field measurement, field observation) commenced. If a site activity is essentially instantaneous, a Site End Date is often not specified.	PRJ_SITE_STR_DT	Date, MM/DD/YYYY format. A date of 1/1/1900 indicates that a Field Activity Start Date is not specified or is unknown.
Project Site End Date	The date that the site activity (sample collection, field measurement, field observation) ended. If a field activity is essentially instantaneous, a Site End Date is often not specified.	PRJ_SITE_END_DT	Date, MM/DD/YYYY format. 03/12/2003

***Table 4*: Spatial and Temporal Data Elements Associated with Project Site Features**

Level 3 **Elements listed below are not necessarily mandatory or applicable to all project sites**			
Logical Name	**Element Definition**	**Physical Name (For Example Only)**	**Element Code or Code Range**
Site Feature	The structure, form, or appearance of what is being tracked, measured or observed at any given project site. Within any give project site there may be various features represented as single points, linear features or aerial extents.		*This need to be defined based on the type of scientific/field information that is being collected* *Example Code Tables:* ▪ *Transect measurement point* ▪ *Fence* ▪ *Wells* ▪ *Fish hatchery raceway* ▪ *Reach segments* *Examples of Site Features:* *Water sampling well locations* ▪ *Individual gauging station location* ▪ *Location of addition to spawning gravel*
Site Feature Location Description	Term that best describes the feature location in relation to the surrounding environment. Information that describes the place a Location exists.	SITE_FEA_LOC_DESC	Text field Example: 200 yards north of the cattle crossing on Laumann Road, north of the intersection with Heidi Road
Site Feature Location Latitude Coordinate	Distance north or south of the equator. Decimal equivalent to the	SITE_FEA_LOC_LAT_COORD	Float, 3 places, 6 decimals; Range for WA: 45.000000-49.999999

	degrees-minutes-seconds latitude value of a		
Site Feature Location Longitude Coordinate	Distance east or west of the Central Meridian (Greenwich, England). Decimal equivalent to the degrees-minutes-seconds longitude value.	SITE_FEA_LOC_LONG_COORD	Float, 3 places, 6 decimals; will accommodate signed values; Range for WA: -116.000000 – -125.999999
Site Feature Horizontal Datum	Model used to match the horizontal position of features on the ground to coordinates and locations on a map. NOTE - When taking GPS measurements, it is very important to record your datum!	SITE_FEA_HORZ_DAT	01 - N. American Datum 1927 (NAD27- used on many USGS quad maps or NOAA charts); 02 - N. American Datum 1983 (NAD83 or 91 Adj. – based on Earth and satellite observations, similar to WGS84 but specific to North America.); 03 - High Accuracy Reference Network (HARN – similar to NAD83, but more accurate per GPS observations); 04 - World Geodetic System of 1984 (WGS84 – world datum, based on Earth and satellite observations); 99 - unknown.
Site Feature Location Collection Method	Technique used to collect the horizontal coordinates of a feature location.	SITE_FEA_LOC_COLL_MTH	1 - Address Matching - Block Face; 2 - Address Matching - House Number; 3 - Address Matching - Street

			Centerline; 4 - Address Matching - Unknown; 5 - Aerial Photography - Rectified; 6 - Aerial Photography - Unknown; 7 - Aerial Photography - Unrectified; 8 - Cadastral Survey (conventional land survey); 9 - Census Block 1990 Centroid; 10 - Census Block Group 1990 Centroid; 11 - Conversion from STR; 12 - Digital or manual raw photo extraction; 13 - Digitized off CTR screen/digitial data; 14 - Digitized - paper map; 15 - GPS carrier phase (employs the satellite code's carrier signal to improve accuracy); 16 - GPS code phase (measurements based on pseudo random code broadcast by satellite); 17 - GPS kinematic (tracking location while moving using carrier phase); 18 - GPS (Unknown); 19 - Hand measured - paper map (interpolation); 20 - LORAN-C; 21 - Orthophotography - digital;

			22 - Orthophotography - paper; 23 - Satellite Imagery - Landsat MSS (Multi-Spectral Scanning); 24 - Satellite Imagery - Landsat TM (Thematic Mapper); 25 - Satellite Imagery - Other; 26 - Satellite Imagery - SPOT Panchromatic; 27 - Satellite Imagery - SPOT Multi Spectral; 28 - Zip Code Centroid; 29 - GPS (Code/Differential); 99 - unknown
Site Feature Start Date	The date that the feature activity (sample collection, field measurement, field observation) commenced. If a Feature activity is essentially instantaneous, a Feature End Date is often not specified.	SITE_FEA_STR_DT	Date, MM/DD/YYYY format. A date of 1/1/1900 indicates that a Field Activity Start Date is not specified or is unknown.
Site Feature End Date	The date that the feature activity (sample collection, field measurement, field observation) ended. If a feature activity is essentially instantaneous, a Feature End Date is often not specified.	SITE_FEA_END_DT	Date, MM/DD/YYYY format. 03/12/2003

Site Feature Start Time	The time that the feature activity began, for example the time of sampling	SITE_FEA_ST_TM	**Feature Start Time** (time the collection, measurement, observation started - using a 24hr clock at local time) (hhmmss) e.g. 164322
Site Feature End time	The time that the feature activity ended, for example the end of sampling	SITE_FEA_END_TM	**Feature End Time** (time the collection, measurement, observation ended - using a 24hr clock at local time) (hhmmss) e.g. 175231

Table 5: **Optional Elevation Data Elements Associated with Projects, Sites or Feature**

Logical Name	Element Definition	Physical Name (For Example Only)	Element Code or Code Range
Elevation	The measure of the elevation of the project site above a reference datum.	PRJ_SITE_VERT	Float, will accommodate signed values
Elevation Units	The unit of measurement used to describe the elevation value.	PRJ_SITE_VERT_UNIT	Text field; example Meters Feet
Elevation Datum	The code for the reference datum used to determine the vertical measure	PRJ_SITE_VERT_DAT	Navd88 Ngvd29 Mean Sea-Level Local Tidal Datum Other
Elevation Collection Method	The technique used to establish the elevation or depth of the sampling site	PRJ_SITE_VERT_COLL_MTH	Gps Carrier Phase Static Relative Position Gps Carrier Phase Kinematic Relative Position Gps Code (Pseudo Range) Differential Gps Code (Pseudo Range) Precise Position Gps Code (Pseudo Range) Standard Position (Sa Off) Gps Code (Pseudo Range) Standard Position (Sa On) Other Altimetry Precise Leveling-Bench Mark Leveling-Non Bench Mark Control Points Trigonometric Leveling Photogrammetric Topographic Map Interpolation

Examples of Spatial and Temporal Data Reporting for Different Types of Data Collection Efforts

The spatial and temporal standards described in this document are for use in any *Observation Based Data* collection effort. *Observation Based Data* are generated during an *activity* (e.g. fish counting, habitat survey), performed by *participants* (e.g. Data Collector) where *observations* (recorded data) are collected about a subject (e.g. fish passage) following a *methodology* (screw trap method 2) at a *location* during a *period* (05-4-2005 to 05-8-2005) and for a particular *purpose* (measuring smolt production).

While data analysts usually want to know all of the *italicized* information above, this document is intended to provide minimum standards reporting on the *location* and the *period* of an Observation Based Data collection effort.

There are many different types of participants involved in data collection with different levels of technical support. Examples are provided below for two types of *participants*, *independent* data collectors and *corporate* data collectors. Independent data collectors would typically be working on a smaller scale projects, often without support from a corporate information system. A collector working within a *corporate* information system would usually be supported with enterprise level GIS support, for example most participants working for a government scientific program typically have enterprise GIS support.

Independent Data Collector, Example 1

The participant collects water quality data in a stream environment and determines the sampling location from a paper map. The time of sampling is reported from a personal watch that is not synchronized. Later, in the office, the user logs onto a map web service e.g. http://www.maptech.com/ or http://www.topozone.com to identify the sampling latitude and longitude (in decimal degrees) from the map web service.

The participant would report, at least, a brief metadata description of the location method: e.g. "I marked the location on a 1:100,000 typographical map in the field and then used the http://www.maptech.com/ or http://www.topozone.com web service to get a lat/ long in decimal degrees. Time of sampling was reported from a personal unsynchonized watch".

Independent Data Collector, Example 2

The collector is validating the planting of an area of riparian planting. While the site can be located, survey stakes cannot be located to delineate the work site. The collector walks to the estimated center location (centroid) of the tree-planting project and measures the location using a hand held GPS. Later, in the office, the collector keys the location information from the GPS into a spreadsheet and makes a note in the metadata record, "I walked to the approximate center of the planting and estimated the location with a

"Garmin E-Trex" GPS using an unknown methodology. The datum used was NAD83 (N American Data 1983). I could not locate survey stakes."

Corporate Data Collector, Example 1

The corporate participant collects water quality data in a stream environment from multiple sites and observes and reports the sampling locations in decimal degrees and the time of sampling (dd-mm-yyyy, hh-mm-ss 24hr clock) into a PDA with an integrated "Garmin 18" GPS unit. The time is taken from the GPS. On return to the lab the GPS data is downloaded from the users PDA to a corporate database and a metadata record is attached, including a reference to the datum used (NAD83) and a reference to the use of automatic loading of spatial and temporal data from the Garmin GPS 18 unit.

Corporate Data Collector, Example 2

The collector is validating the planting of an area of riparian planting. While the site can be located, survey stakes cannot be located to delineate the work site. The collector describes a polygon (shape file) for the boundary of planting by walking the boundary of the planting and using a hand held GPS to enter waypoints at changes of direction along the boundary. In the office the data is down loaded from the GPS into the corporate database.

In addition to any other metadata needed, a spatial and temporal metadata record would be attached to the data: For example: "The area of planting was located by walking the perimeter of the planting using a hand held Garmin Map 60 GPS, reporting way points at boundary direction changes. The datum was NAD83 (N American Data 1983). In the office the data was downloaded into the database."

Table 6: **Examples of Spatial and Temporal data reporting for different types of data collection efforts**

Feature Name	Examples of spatial/temporal reporting detail from *independent* data collectors	Examples of spatial/temporal reporting detail from *corporate* data collectors
Install Fish Screen	• Location of screen (Lat/Long dec degree). • Datum used • Date of install: mm/dd/yyyy	• Location of screen (Lat/Long dec degree) • Datum used • Date of install: mm/dd/yyyy
Stream Bank Stabilization	• Start and end point of stabilization (Lat/Long dec degree) • Datum used • Date of stabilization: mm/dd/yyyy	• Polygon of stabilization area (Lat/Long dec degree) • Datum used • Date of stabilization: mm/dd/yyyy
Riparian Area Treated	• Start and end point (Lat/Long dec degree) • Datum used • Date of treatment: mm/dd/yyyy	• Polygon of area treated (Lat/Long dec degree) • Datum used • Date of treatment: mm/dd/yyyy
Road Obliteration Project	• Start and end point (Lat/Long dec degree) • Length of treatment • Date of obliteration: mm/dd/yyyy	• Line detail of road treatment (Lat/Long dec degree) • Date of obliteration: mm/dd/yyyy
Sediment Control Basin	• Centroid of basin (Lat/Long dec degree). • Datum used • Date of sediment control: mm/dd/yyyy	• Polygon of basin (Lat/Long dec degree) • Datum used • Date of sediment control: mm/dd/yyyy
Wetland Creation Project	• Centroid (Lat/Long dec degree) • Datum used • Date of wetland creation: mm/dd/yyyy	• Polygon (Lat/Long dec degree) • Datum used • Date of wetland creation: mm/dd/yyyy
Invasive Species Treatment	• Centroid of treatment area • Datum used • Date of treatment: mm/dd/yyyy	• Polygon of treatment area (Lat/Long dec degree) • Date of treatment: mm/dd/yyyy
Hatchery Fry/Smolt Release	• Location of point of release (Lat/Long dec degree) • Date and Time of release mm/dd/yyyy, hhhh/mm/ss • Datum used	• Location of point of release (Lat/Long dec degree) • Date and Time of release mm/dd/yyyy, hhhh/mm/ss • Datum used
Sampling Site	• Location (Lat/Long dec degree) • Datum used • Date and time of sample: mm/dd/yyyy, hhhh/mm/ss	• Location (Lat/Long dec degree) • Datum used • Date and time of sample: mm/dd/yyyy, hhhh/mm/ss

Livestock Exclusion Fencing	• Start and end point (Lat/Long dec degree) • Datum used	• Line detail (Lat/Long dec degree) • Datum used