

***Interim Guidance for Developing  
Global Positioning System  
Data Collection Standard  
Operating Procedures  
and  
Quality Assurance Project Plans***

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## **The Question**

- “How can we harmonize GPS Data Collection Activities to address quality issues, enrich confidence, improve interoperability, increase administrative efficiency, and facilitate QA review and evaluation?”

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## **Background**

- 2002
  - A Geospatial Quality Council (GQC) survey found that most Regions and Program Offices do not have a Standard Operating Procedure (SOP) for Global Positioning Systems (GPS) Data Collection Activities.
    - *Impact* – Low confidence in interoperability and shared information.

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## *Background*

- 2003
  - The GQC published the **GPS-Technical Implementation Guidance** – provides guidance on the technical, quality-related aspects of GPS and general guidance for writing GPS-SOPs.

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## *Background*

- 2007
  - Region 5 submitted a GPS-SOP and QAPP based on the GPS-TIG and other GQC products for transformation to a template for anyone to use.
  - The GQC factored-in the EPA Graded Approach
- 2008
  - GQC published the new guidance.

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## Guidance for Developing GPS SOP & QAPP

- Section 1: GPS SOP
  - Template SOP
  - Provides examples of EPA Graded Approach
- Section 2: Condensed requirements for a QA Project Plan
- Section 3: GPS Data Collection QAPP
  - Template QAPP

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## Section 1: GPS-SOP

- Planning and Implementing a GPS Survey
- Pre-Survey Planning
- **Define Objectives of the Survey**
- Define Project Area
- Determine Observation Window and Schedule of Operations
- Establish Control Configuration
- Select Survey Locations
- Coordinate Pre-Survey Plans
- **Equipment Testing and Logistics**
- Prepare the Quality Assurance Project Plan
- Survey Execution
- Establishing a Schedule of Operations
- **Pre-Survey: The Day Before**
- Pre-data Collection: Establishing a Base Stations
- Data Collection: Performing the GPS Survey
- Data Assessment, Processing and Validation
- Data Transfer
- Data Assessment and Initial Processing
- Computation
- Data Conversion to GIS
- **Metadata Documentation and Reporting**

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## Define Objectives of the Survey

- **Graded Approach is introduced via Categories:**
- **Category I:** For enforcement, litigation, direct support of rules & regulations, projects of national significance and highly influential scientific assessment
- **Category II:** Development of rules & regulations and influential scientific information
- **Category III:** Validation, general applications and feasibility studies
- **Category IV:** Screening, exploratory and pure knowledge

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## ***Equipment Testing and Logistics***

- Modern GPS units contain many settings that can serve as quality checks during data acquisition. For instance, a minimum number of visible satellites can be specified for data acquisition. The unit will provide a warning signal if less than the minimum specified are available. Four satellites in view are the minimum required, but additional satellites can provide the receiver with stronger signals to select from and perhaps better geometry for calculation.

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## ***Equipment Testing and Logistics***

- A “Dilution of Precision” (DOP) value can be calculated for “Horizontal” (HDOP), Time (TDOP), and General Position (PDOP). These can be programmed into the unit and/or software.
- Suggested Categories for DOP follows:

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## **DOP Values in Relation to Quality Categories**

<b>DOP Value</b>	<b>Rating</b>	<b>Description</b>	<b>Suggested Quality Catgry</b>
1	Ideal	Highest possible confidence level	I
2-3	Excellent	Most demanding needs	I or II
4-6	Good	Appropriate for most needs	II, III, or IV
7-8	Moderate	Less demanding needs	IV
9-20	Fair/Poor	Rough estimate/Discard	Not Rcmnded

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## **Pre-Survey: The Day Before**

- A GPS Pre-Survey Checklist is included to facilitate “readiness” before going to, and while in the field. The checklist includes sections on:
  - Logistics – maps, GPS-Satellite Almanac, etc,
  - Field Equipment – list of equipment
  - Last Minute Checks – Batteries, etc
  - In-The-Field Checks – Locate Base Stations, Initialize equipment, etc

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## **Metadata Documentation and Reporting**

- EPA, *Geospatial Metadata Technical Specification v. 1.0*, November 2, 2007.
- [http://geodata.epa.gov/docs/EPA\\_Geospatial\\_Metadata\\_Technical\\_Specification\\_v1\\_11\\_2\\_2007.pdf](http://geodata.epa.gov/docs/EPA_Geospatial_Metadata_Technical_Specification_v1_11_2_2007.pdf)

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## **Metadata Documentation and Reporting**

- For data collected using GPS, accuracy information can be collected to document the limitations of the unit itself, the accuracy for a given collection, and other steps involved in data processing. The following information should be reported in the metadata:
  - type of GPS equipment,
  - data collection methodologies and settings,
  - inherent GPS errors, and
  - post-processing techniques.

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## **Section 2: GPS QAPP Requirements**

- Provides the EPA QA Policy, Requirements and Guidelines for QAPP
- Discusses Spatial QAPP Considerations referencing the EPA QA “G5G”
- Provides detailed definitions of QA Categories
- Provides an example of applying the Graded Approach to the G5G elements

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## **Section 2: GPS QAPP Requirements**

G5G Element	Description	Simple QAPP	Complex QAPP
A.3.c.	Sat. Observation Window	Not Calculated	Calculated
A.3.d.	Control Configuration	Use DOP Settings	Differential Correction
A.5.a.	Data Quality Objectives	≥ 10 Meters	< 10 Meters
A.5.b	Receiver Performance	PDOP ≤ 6	PDOP ≤ 4

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### **Section 3: GPS QAPP Template**

- Derived from EPA *Guidance for Geospatial Data Quality Assurance Plans*, EPA QA/G-5G, March 2003 [EPA/240/R-03/003] and tailored for point data collections which are the most common surveys.
- Surveys to collect polygon or line data would require additional modifications in the template.

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### **Section 3: GPS QAPP Template**

- User edits Blue Text to create project-specific QAPP.
- The consistency provided by the pre-organized QAPP facilitates completion by the user, and review by the QA Professional.
- Pre-filled tables describing various operations create uniformity in approach.

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### **Section 3: Example of Pre-completed approach**

Report	Content	Frequency
Project Status Report by Project Manager	Status of Tasks in Section A.4 above	Bi-Weekly Updates
Data Acceptance Report by the GPS Operator	Data Collection, Quality Check Results and Processing Results	Once Upon Completion
Final Project Report by Project Manager	Summary of Project Accomplishments	Once Upon Completion

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### **Benefits & Impact**

- Improves the administrative efficiency and the interoperability of GPS data collected by stakeholders by harmonizing the approaches used to develop GPS data collection SOPs and QAPPs.
- Reduces the time scientists spend on writing GPS SOPs and QAPPs

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## ***Benefits and Impact***

- Decreases the time necessary to gather locational data for responding to emergency situations.
- Provides consistency in implementing the Graded Approach.
- Some Regions are requiring extramural stakeholders to use the GQC guidance documents.

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## ***For more information...***

- EPA Geospatial Quality Council website  
<http://www.epa.gov/nerlesd1/gqc/default.htm>

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