DRAFT STANDARD OPERATING GUIDELINES FOR GIS SPECIALISTS

ON INCIDENT COMMAND TEAMS

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CALIFORNIA DEPARTMENT OF WATER RESOURCES
EMERGENCY RESPONSE SUBCOMMITTEE OF THE ENTERPRISE GIS COMMITTEE

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EXECUTIVE SUMMARY

In October 2010, the Emergency Response (ER) GIS Subcommittee of the Department of Water Resources (the Department) Enterprise GIS Committee formed with the mission of improving spatial data exchange during emergency response. The ER GIS Subcommittee learned from flood managers shortly after its formation that Standard Operating Guidelines (SOG) are needed for ER GIS Specialists on Incident Command Teams. This SOG benefits the Department by documenting the expectations of GIS Specialists and providing guidelines for the best practices and resources available to serve those expectations.

The ER GIS Subcommittee developed these guidelines using the structure and some content of the National Wildlife Coordinating Group (NWCG) Geographic Information System Standard Operating Guidelines (GSTOP). As GSTOP was created for fire response, this document will serve the needs of GIS Specialists during flood response. This SOG covers GIS data management, map production, incident GIS documentation and archiving, team transition, and general guidance for the GIS Specialist.

CHAPTER 1 MINIMUM EXPECTATIONS

PURPOSE

This chapter outlines the minimum expectations for the GIS Specialist on an Incident Command Team (ICT) in the Department of Water Resources, including:

- Critical items for GIS operations
- Required knowledge, skills, and abilities
- Procedures the GIS Specialist can be expected to follow

CRITICAL ITEMS FOR GIS OPERATIONS

HARDWARE

- PC or laptop with DVD writer, USB ports, sufficient RAM to run current version of GIS software, and administrator privileges
- Video/Graphic Adaptor 256 MB RAM or higher recommended (NVIDIA, ATI and INTEL chipsets supported)
- Printer with paper
- Connection cables, hubs, power supplies
- External portable hard drive loaded with basemap data (the Decision Support Section of Hydrology and Flood Operations Office of the Division of Flood Management offers these for loan)

SOFTWARE

- ArcGIS Desktop, standard current version recommended, with licensing activated for use while disconnected from the network
- Appropriate software extensions and tools turned on
- GPS download utility such as DNR GPS (available as a free download from http://www.dnr.state.mn.us/mis/gis/DNRGPS/DNRGPS.html)
- Adobe Acrobat (version 9 or later recommended for optimal use of converted pdf maps); or Adobe Reader (current version)

INFRASTRUCTURE

- Power at the work site
- Uninterruptible Power Supply (UPS) with battery backup—surge protection
- Internet connection and service, if available

MEDIA

- USB thumb drive or portable hard drive of adequate size to store incident data
- Blank CDs or DVDs

DATA

- Refer to Chapter 4 table for the minimum essential datasets

GIS SPECIALIST KNOWLEDGE, SKILLS, AND ABILITIES

The GIS demands on an incident are independent of the complexity level of an incident. It is possible to have a very complex GIS situation on an incident of minimal complexity; therefore, as a prerequisite to service as GIS Specialist, personnel should have the following knowledge and abilities:

KNOWLEDGE

During an emergency incident GIS specialists need to be just as trained in the incident command structure and how ICTs function as the rest of the emergency personnel are. All personnel assigned to an Incident Command Team (ICT) must have knowledge of the Incident Command System (ICS) structure and procedures, outlined in the self-study courses on the Federal Emergency Management (FEMA) website. All persons serving on an ICT are required to have completed courses ICS-100, ICS-200, and ICS-700 within the past five years. This training covers both the organizational structure of the ICS, and general function of the sections, units, and individual positions that make up the ICT. Additionally, familiarity with DWR Incident Command System Field Operations Guide 420-1/P is also required.

GIS Specialists must be able to:

- Effectively use standard GIS software (ArcGIS Desktop) with a variety of data types (raster, vector and table) including geodatabases, feature classes and shapefiles.
- Understand Global Positioning System (GPS) data collection methods and be able to download, process, and incorporate the data. (Refer to Appendix B)
- Understand the use of projection and datum, including geographic coordinates (latitude and longitude), and be able to re-project data in multiple formats.
- Understand the safety of incident personnel and the public are the first priority of the ICT. Commitment to and accountability for safety is the responsibility of all ICT members.

SKILLS AND ABILITIES

GIS Specialists must be able to:

- Effectively use ArcGIS (current version) to create maps using ICT- templates and standard symbology, and perform spatial analysis as required for the situation.
- Work with a variety of spatial data types (raster and vector), including knowledge of data file types such as shapefiles, feature classes, tables, and geodatabases.
- Quickly provide answers to questions such as:
    - Where is the levee break?
    - Where is the flood fight material?
- Troubleshoot hardware and software problems sufficient to keep the GIS Specialist operational. This may include basic computer installation, software management, and installing printer drivers.
- Communicate effectively with internal and external people to the ICT doing the following:
    - Explain technical issues or concerns.
    - Train others in basic map reading.
    - Exchange technical information.
- Perform the role of GIS Specialist in "incident conditions" which may include the following:
    - Long hours (12+ hour operational periods, day and night)
    - Close working quarters shared with other personnel
    - Stressful situations
    - Travel away from home base for up to 14 days
    - Primitive conditions (portable toilets, limited food choices)
    - Working with personnel from federal, state, and local agencies, contractors, or prison crews

INCIDENT PROCEDURES

FIRST NOTICE

At the first notification of possible activation:

- Prepare to be self-sufficient; the GIS Specialist will need a dedicated GIS laptop or PC loaded with software, common templates, and an external hard drive loaded with common base data. Coordinate with the ICT command and logistics staff to ensure this gets to the site.
- Recognize that a printer may not be immediately available, and it is not likely that a plotter will be available on-site; prepare preprinted paper maps of the affected area to make available to IC staff.
- Contact the Flood Operations Center Decision Support Section at (916) 574-2632 to obtain an external drive with GIS Data, the GIS Toolbox of preprinted maps, and miscellaneous equipment. The GIS Specialist should review the datasets to determine if they are adequate for use on the incident, see Chapter 4 for review details.

MOBILIZATION OPERATIONAL PERIOD

Setting up the GIS operations and running through the operational period:

- Check in according to incident check-in procedures. Refer to the DWR Field Operations Guide 2012, Technical Specialists section beginning on page 47.
- Meet with the Incident Command (IC) Planning Section Chief to establish location, rules, and expectations, as well as planning a timeline for map production
- Analyze the data, hardware, personnel, and supplies available. If additional hardware, supplies, or personnel are needed for effective GIS productivity, follow ordering procedures. Orders for GIS are submitted through the IC Planning Section Chief to the Logistics Section.
- Set up computer, workspace, and map display.
- Set up the file directory structure as outlined in Chapter 2.
- Initiate Unit Log, ICS Form 214 (Appendix B) in accordance with Chapter 3.
- Insert base data into directory structure.
- Establish coordinate system and units standard for the incident data.
- Establish boundary of the incident's area of interest.
- Gather what incident data you can; collect hard-copy maps already in use.
- Generate map products according to the standards in this guidebook and in accordance with the Incident Command timelines and priorities.

OPERATIONAL PERIODS

During the incident there are daily activities that a GIS Specialist should be doing, the following section lists some of those. Be aware that additional needs come up and GISS will have to prioritize requests. Previously GISS have created simple map request forms for use out in the field to triage requests as they come in. These requests can contain the elements wanted on the map, person requesting the map, deadline or urgency and whom the map is for. Having map requests written out like this helps delegate tasks in the field too.

- Meet with the Incident Command (IC) Planning Section Chief to get timeline for when they would like the maps and if they need additional maps generated for briefings.
- Generate map products according to the standards in this guidebook, the Incident Command timelines and priorities, and as requested by the Plans Chief.
- Archive your documents daily in the folders designated by the Documentation unit.
- Periodically throughout the day check with the Flood Operations Center GIS specialist via email or phone to ensure good communication and data exchange.

The GIS Specialist is responsible for the following:

- Collecting, processing, and disseminating incident-related spatial data
- Maintaining the standardized filing structures (Chapter 2)

- Collecting and maintaining the minimum essential datasets (Chapter 4)
- Creating new data as needed for incident operations
    - Incorporating data from Global Positioning System (GPS) units, phone reports, and other sources
    - Digitizing flood inundation perimeter and other incident data
- Creating necessary products (Chapter 6) using the defined Map Symbology (Chapter 5) within the agreed upon time period
- Compliance with security data management agreement (Chapter 3, Chapter 7, Chapter 8)
- Transferring the products, projects, and data created in GIS to other personnel on the incident and/or to the Flood Operations Center (FOC)
- Reading logs from previous GIS Specialists that have been assigned to this incident to stay informed of any known hardware, software, or data difficulties and concerns they may have noted

DEMOBILIZATION PERIOD

As an incident comes to a close there are tasks that a GISS needs to ensure are completed. While an incident is demobilizing, the GISS is still going to be producing the maps detailed above. In addition, the GISS should do the following:

- Compile a list of data you had to obtain during the incident to support emergency response that was not included in the data supplied on the portable hard drive. If you needed something we overlooked, it would be great to include this for everyone to have next time.
- Note any supplies or items that you would like to have on an incident.
- Participate in after-event hot washes both with your command team and with the GIS Emergency Response subcommittee. Feedback we get after an event contributes to the improvement of these processes and documentation.

OTHER GIS RESPONSIBILITIES ON AN INCIDENT

PLANNING CHIEF GIS RESPONSIBILITIES

With regard to the GIS Specialist, the Planning Chief is responsible for the following:

- Directing and prioritizing all tasks of the Section including the GIS functions, allowing for individual strengths when making assignments
- Coordinating and prioritizing incoming requests—especially those by public information officers, cooperators, and others
- Requesting map products
- Monitoring the workload
- Authorizing the distribution of data or products related to the incident

- Ordering the necessary equipment or people to accomplish the GIS work effectively (computer support, power, equipment)

OTHER PERSONNEL GIS RESPONSIBILITIES

Other personnel collecting geospatial data on the incident are responsible for the following:

- Knowing how to use the GPS units and having GPS cables available for uploading the data
- Knowing coordinate system format and datum in use for the incident for reporting and communicating geographic locations
- Being aware that different communities of expertise use different conventions for reporting locations, not assuming you know which convention they are using, asking explicitly
    - Degrees, Minutes, Seconds
    - Decimal Degrees
    - Degrees, Minutes, Decimal Minutes 36’ 42.450”

COMMUNICATIONS

The GIS specialist will maintain a professional demeanor when communicating with incident personnel and technical staff from outside the incident. When communicating within the Incident Command Team, the GIS Specialist will follow the Incident Command Structure chain-of-command at all times. Incident communications, such as requests for materials, maps, or information, are tracked using the ICS 213, General Message Form.

Whenever there is more than one GIS Specialist on an incident, one may be designated as the “lead” to coordinate and communicate with the Planning Chief/Incident Command.

CHAPTER 2 FILE NAMES AND DIRECTORY STRUCTURE

PURPOSE

This chapter provides the GIS Specialists with guidelines for standardized file names and directories for GIS data and related documents created and used on incidents. The structure design will provide a consistent file naming and data structure that is repeatable, clear, and enables consistent archiving of incident geospatial data. The intent is to have a structure that leads to efficient work methods while allowing the field GIS specialist flexibility to meet the business needs of fieldwork in a timely manner.

The incident directory structure provides a framework for storing and using GIS data and documents. Ensuring that all incident GIS files are stored in the proper location within a standardized directory structure is important to ensure efficient workflow, reduce ambiguity, and enable the data archival process. This system will promote effective communication by the Incident GIS Specialist to the Flood Operations Center and other organizations supporting the incident.

SPECIFICATIONS

The file name and directory structures are designed to include incident-specific identification information.

FILE NAMING CONVENTIONS

The following are guidelines for naming files:

- File names cannot be longer than 255 characters. Note: long files more than 128 characters for path name may not allow backup onto CD or DVD
- File folder names must not contain spaces or periods, aside from the file extension delimiters
- The underscore "_" is the only allowable character for delimiting name elements
- File names for specific layers should include descriptive data about the incident
- File names must be complete and stand on their own outside of the file structure
- File names for feature classes within a file geodatabase must start with a letter
- Capital letters may be used to make names easier to understand
- The format for dates is 8 digits in year, month, day order (yyyymmdd)
- The format for time is 4 digits in a 24 hour format (hhmm)

See the last part of this section for standard abbreviations.

INCIDENT DIRECTORY STRUCTURE

This structure can be stored in any location; however, the following describes the core directories to be present for every incident, and does not preclude the addition of other folders.

ANNUAL COMPILATION OF INCIDENTS

According to agency needs, files for multiple incidents may be stored under a root folder named **yyyy_Incidents** located at root level, where yyyy = the current calendar year.

INCIDENT FOLDER

The incident folder should be named **yyyy_incident_name**, for example 2011_Twitchell, where yyyy isthe year the incident started. The Incident Folder will have subfolders for base data, documents, incident data, products, projects, and tools.

BASE DATA FOLDER

The base data folder should be named **base_data** and contains base data not created on the incident. Subfolders should separate other data into the following folders:

Folder Name	Folder Contents
dem	digital elevation model data and derived products
logos	agency logos, typically in non-geospatial raster format
raster	raster geospatial data (can include orthoimagery or scanned quads)
vector	vector geospatial data

DOCUMENTS FOLDER

The documents folder should be named **Documents** and contains the following: spreadsheets, text documents, unit logs, digital photos used on maps, etc.

INCIDENT DATA FOLDER

Incident data is to be created daily. This daily production of data should be stored by date. The top incident data folder should be named **Incident_data** and should contain additional subfolders as follows:

Folder Name	Folder Contents
incident_spatial_data	This is your active geospatial incident data.
yyyymmdd	Daily incident data with date/time stamps. This would be a daily archive of the incident geospatial data folder contents.
gps	This is an optional folder but would contain GIS data from field GPS downloads.

Folder Name	Folder Contents
modified_base_data	This contains base data that has been edited for the incident, for example, roads, ownership and structures.
Progression	This is your workspace to document the progression of water or an inundation process.
IR, FOC_data	These are optional.

PRODUCTS FOLDER

The products folder should be named **Products** and contains GIS product files produced on the incident. Subfolders should separate products as follows:

Folder Name	Folder Contents
yyyymmdd	All products for an intended date (this is similar to having data folders separating data created on different dates). Move products into folders named for the date they are intended to be used on, for example if you are making a map for tomorrow morning's briefing meeting it would go into a folder with tomorrow's date.
Final	Copies of all final products for the incident should go here.

PROJECTS FOLDER

The projects folder should be named **Projects** and contains GIS project files such as project tasks and daily map document files.

Folder Name	Folder Contents
Master Map Document Files	The master map document files, one for each map product.
yyyymmdd	Contains backup map document files copied from master map document files.

See **Figure 1 Sample Incident Directory Structure** for an example of the suggested directory structure.

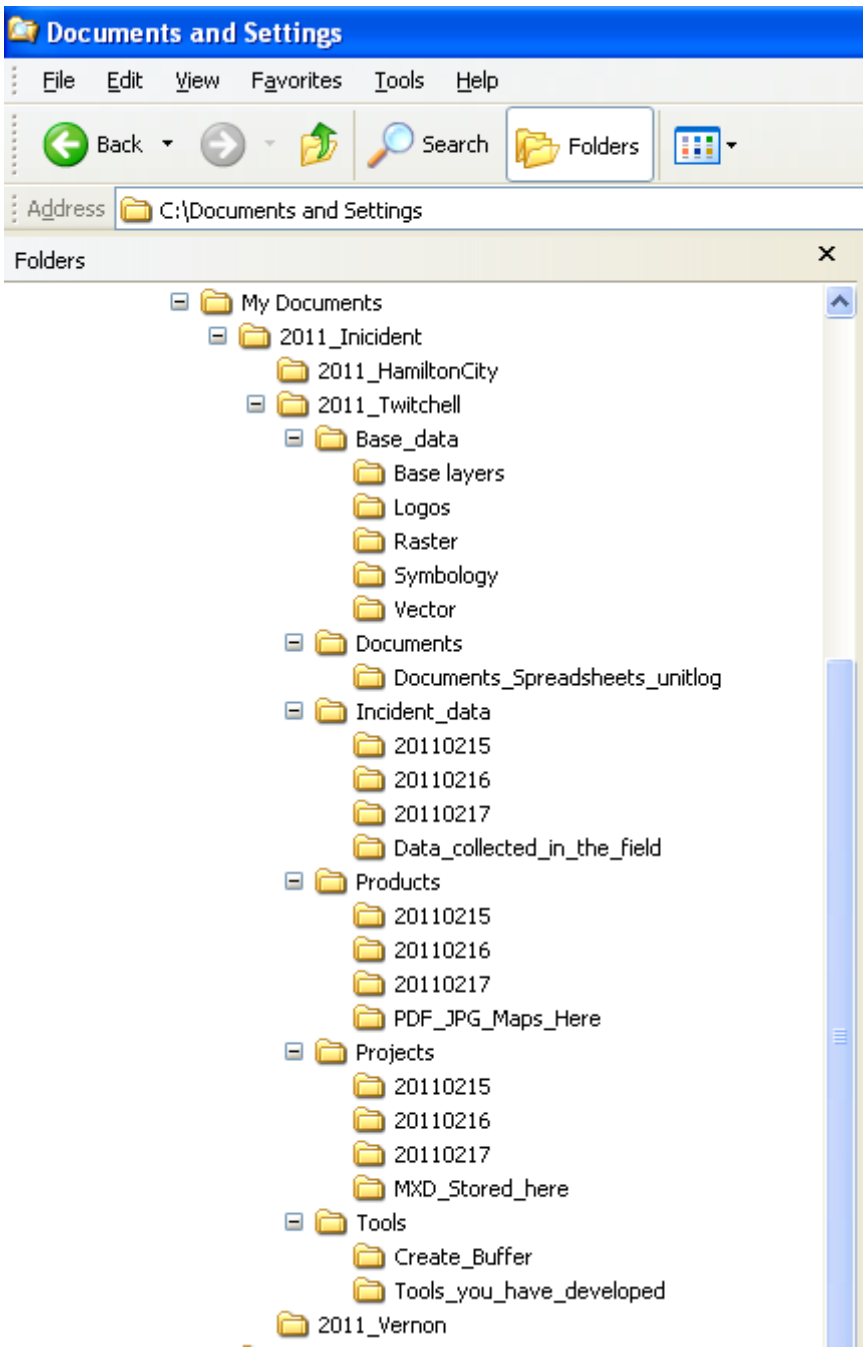


Figure 1 Sample Incident Directory Structure

TOOLS

This folder should archive any customized tools, extensions, scripts or specialized software used during the incident.

STANDARDABBREVIATIONS

This is a list of standard abbreviations for file naming. For other features, select an unambiguous term. An example of how to use these terms might be a shapefile of GPS Points collected by someone: **20070502_gps_Green**.

INCIDENT DATA TYPES

Abbreviation	Explanation
damage	Damage caused by incident or response efforts
icp	Incident Command Post
ics_pt	ICS points symbolized with ICS symbology

SOURCE CODES

Abbreviation	Explanation
gps_name	Global Positioning System (add collector's name).e.g., gpsjones
fobs	Incident Command Post

COORDINATE SYSTEM CODES

These coordinate system codes are for shapefiles and are not needed with file geodatabases. The convention to follow here is coordinate system, datum. Some examples are as follows.

Abbreviation	Explanation
u10n27	Universal Transverse Mercator (UTM) Zone 10, NAD 27
u13n83	UTM Zone 13, NAD 83
lln83	Latitude-Longitude (Geographic), NAD 83
{ca}sp5n27	{State abbreviation} State Plane Zone 5, NAD 27
cta83	California Teale Albers, NAD 83

PRODUCT TYPE

Abbreviation	Explanation
brief	Briefing Map
dam	Damage Assessment Map
facil	Facilities Map
IAP	Incident Action Plan Map
owner	Ownership map
plans	Situation Plans Map
rehab	Rehabilitation Map
struc	Structural Protection Map
trans	Transportation Map

PAGE ORIENTATION

Abbreviation	Explanation
land	Landscape
port	Portrait

DATE FORMAT

Abbreviation	Explanation
yyyy	Year in which the incident began, e.g., 2012
yymmdd	Year, month, day, e.g., 20120315
hhmm	Hours and Minutes, 24 hour clock, e.g., 0945

FILE NAMING AND DIRECTORY STRUCTURE RESPONSIBILITIES AND COMMUNICATIONS

It is the responsibility of the GIS Specialist to communicate the file naming and directory structure used on an incident to other GIS Specialists, including the hosting unit GIS staff and regional GIS staff.

The Situation Unit under the Planning section is responsible for ensuring that the GIS file naming and directory structure standards are in place for the incident. The standards outlined in this chapter are part of a national interagency standard and should not be overridden at the incident level.

CHAPTER 3 DOCUMENTATION AND METADATA

PURPOSE

This chapter provides procedures for properly documenting GIS Specialist activity and developing metadata for data created in the field that is compliant with a national emergency response standard.

DOCUMENTATION PROCEDURES

Documentation is kept on a Unit Log (Form 214) by the ICT. The log tracks significant events that occur throughout the operational day. The log may be hardcopy, or as digital files with attachments.

Keep a log of events such as the arrival of data from the field, transition of personnel, or data processing. Include an event for one of each type of map (Incident Action Plan (IAP) Maps, Transportation Planning Maps, Incident Briefing Maps) produced per operational period and provide final documents to the documentation unit (under the planning section). This provides a record of significant changes to the incident data and the products produced.

If base data is used or edited, then that base data become modified base data. At this time, the GIS Specialist needs to fulfill the documentation requirements or metadata for these data. The federal standard currently only includes metadata that is described below. At this time, this incident data is categorized as program data so the Enterprise Spatial Data Standards are not applicable to it. It would be wise for the GIS Specialist to remember that the more documentation incorporated into their data the more useful it can be later.

METADATA

SPECIFICATIONS FOR METADATA FILE NAMING

GIS Specialists integrate some metadata in the file name, by way of the specifications discussed in Chapter 2:

- Date, including year (yyyymmdd)
- Time of data collection (hhmm, using 24-hour clock)
- Type of feature portrayed by the data
- Source of data (the ICT position or name of person who collected the data)
- Incident name

RESPONSIBILITIES

The ICT Commander or Planning Chief is responsible for ensuring that the GIS Specialist has the resources needed to fulfill the obligations to the Planning Section. The Planning Chief authorizes documentation and maps the GIS Specialist will provide to the ICT.

The GIS Specialist is responsible for providing documentation to the Flood Operations Center (FOC) and other agencies as directed.

CHAPTER 4 MINIMUM ESSENTIAL DATASETS

PURPOSE

This chapter provides a list of the base datasets that have been identified as the minimum essential datasets needed to meet the business need to make GIS maps in the field, and outlines the process for obtaining datasets, evaluating, transferring data, and storing dataset during an incident/event. The GIS Specialist should be prepared to work with the data at hand since internet connectivity may not be immediately available to obtain the data needed to produce the required maps.

PROCEDURES

The Emergency Response Subcommittee (ERS) has identified minimum base datasets that will be available for GIS staff. These datasets are used to develop both products and analysis on demand and Standard Map Products (Chapter 6).

This chapter distinguishes three classes of datasets:

- Required datasets for Standard Map Products (A)
- Required datasets for Optional Map Products (B)
- Optional datasets (C)

(See Table 4.1 Minimum Essential Datasets)

Each ICT GIS team member is responsible for setting up and maintaining their assigned computer equipment, data, and external drive. The required datasets (A) will be on an external drive issued by the Flood Operations Center (FOC) Decision Support Section (DSS). Staff are also encouraged to download the data from Domain Water>GIS1>DATA>DWR_DATASET_SOP at the beginning of flood season onto an ICT laptop, if access is available. This data collection will be updated before the beginning of each flood season (every October).

Note: When working in the field, store all datasets locally (C Drive, external drive) for access and speed. Chapter 7 will outline archiving datasets after the incident. If the Incident Command Center (ICC) has DWR network access the same data will be stored on: Domain Water>GIS1>DATA>DWR_DATASET_SOP.

The required datasets will be stored in the ISO-19[1] format. The matrix of required datasets includes an index reference to the ISO-19 folder where dataset can be found on the external drives.

EXTERNAL DRIVE REVIEW

When the GIS Specialist picks up their external drive they should review the datasets to determine if they are adequate for use on the incident; this review should include the following elements.

COORDINATE SYSTEM AND DATUM INFORMATION

Datasets for DWR GIS field will be:

- Y - Universal Transverse Mercator (UTM) Zone 10 and Zone 11
- X - North American Datum (NAD) 1983
- Z - Vertical datum or elevation was legislated to be North American Vertical Datum of 1988 (NAVD88)

Coordinate system note: The UTM coordinate system was developed by the United States Army Corps of Engineers in 1940. Currently the World Geodetic System or WGS 84 is used as the underlying model in the UTM coordinate system. Many GPS units default to the WGS 84 system. (Refer to Appendix B for information on bringing GPS data into a map.)

SCALE

For most maps the 1:24,000 should be used to show the Quad or predesigned map background at the optimum scale. This is a standard among various emergency GIS programs, i.e. GSTOP, Cal FIRE, but the needs dictated by the incident may require a different scale.

CURRENCY

Use the datasets that developed for the current water year. The FOC DSS will develop a new dataset bundle annually.

[1] **Spatial Data Standards for the California Department of Water Resources,** Enterprise GIS Committee**,** October 4, 2011, Page 6

ATTRIBUTES

Datasets should contain meaningful attributes as per *Map Product and Deliverables Matrix* (Chapter 6). Use caution with datasets that do not have complete attribution.

SECURITY OF DATA

Some datasets are considered "critical infrastructure" and should not be distributed. These datasets may have been obtained under an agreement to be used only on the incident and should not be publicly distributed. Please check the metadata for details.

Table 4.1 Minimum Essential datasets for map procedures

Dataset	IAP Map	Briefing Map	Transportation Map	ISO Index Where to find this data on the DWR GIS external drive
Class A- Datasets Required for Required Projects	*Special note: Depending on the background basemap used, additional layers such as roads, hydrography, etc. may not be needed.			
Levee Centerlines	R	R	O	17_Structure/LeveeCenterlines
Roads	R	R	R	18_Transportation
Local Roads	O	O	R	18_Transportation/LocalRoads
Hwy, Interstate	R	R	R	18_Transportation/MajorRoads
Hydrography	R	R	R	12_InlandWaters
Rivers	R	R	R	12_InlandWaters/Rivers
Streams	R	O	O	12_InlandWater/hydro_linear
Topographic Base*				06_Elevation
USGS Topo	O	O	O	06_Elevation/USGSTopo24K

Dataset	IAP Map	Briefing Map	Transportation Map	ISO Index Where to find this data on the DWR GIS external drive
ESRI Topo	O	O	O	06_Elevation/Base_Maps
Class B - Optional Datasets				
Administrative Boundaries	O	O	O	03_Boundaries
City	O	O	O	03_Boundaries
County	O	O	O	03_Boundaries
Reclamation Districts	O	O	O	03_Boundaries
Base map background	O	O	O	10_ImageryBaseMapsEarthCover
Hillshade B&W	O	O	O	10_ImageryBaseMapsEarthCover
Hillshade Color	O	O	O	10_ImageryBaseMapsEarthCover
Delta Islands	O	O	O	13_Location
Elevation	O	O	O	06_Elevation
Flood Plain	O	O	O	12_InlandWaters/Sacramento_San Joaquin_CompStudy
Hydrography	O	O	O	12_InlandWaters
Rivers	O	O	O	12_InlandWaters

Dataset	IAP Map	Briefing Map	Transportation Map	ISO Index Where to find this data on the DWR GIS external drive
Streams	O	O	O	12_InlandWaters
Stream Gauges	O	O	O	12_InlandWaters
State Water Project	O	O	O	12_InlandWaters
Levee Centerline	O	O	O	17_Structures/CLD
Levee Historical	O	O	O	17_Structures/CLD
Boils, etc.	O	O	O	17_Structures/CLD
NAIP_2009	O	O	O	10_ImageryBaseMapsEarthCover
Map Books				
LMA Agency Report	n/a	n/a	n/a	Hardcopy/external drive
O & M Map book	n/a	n/a	n/a	External drive

Legend: C- Confidential R-Required layer for product O-Optional Layer - may be added if available

CHAPTER 5 MAP SYMBOLOGY

PURPOSE

The use of standard symbols in mapping flood incidents facilitates fast and consistent interpretations of mapping products. Standard map symbols are required to avoid ambiguous map interpretation, which can become a safety issue during an incident. Symbols are addressed in this chapter to encourage safety, consistency, and readability across maps created digitally or by hand.

SYMBOL SELECTION AND USE

The DWR Field Operations Guide 2012 is the main source for the standard map symbology. This document presents these symbols and suggests additional standard symbols for use by the GIS Specialist on the ICT. General symbology is not included here as a standard for flood fight mapping. However, to ensure clear communication, common map conventions (e.g. blue for hydrologic features) should be observed if possible.

The information conveyed by the map must be the same whether the map is printed in color or black and white. Symbols should be used in conjunction with feature labels or other text to provide clear information to those who will be using the map. Care should be taken to place the identifying text close enough to the map symbol to avoid confusion with nearby symbology.

Choice of symbol size should be at the discretion of the GIS Specialist and the Planning Section Chief. A white halo border may be used facilitate visibility of the symbol or label, but care should be taken to avoid obscuring relevant data underneath.

The symbol ArcGIS .style files will be made available to the GIS Specialist during training, from the FOC GIS Specialist, and on the external data drive distributed to the GIS Specialist. The symbols will also be available individually as graphics files to be incorporated into any GIS software that allows custom symbols.

RESPONSIBILITIES AND COMMUNICATIONS

The GIS Specialist is responsible for using the standard GIS map symbology on an incident. However, the GIS Specialist has the cartographic license to adapt (e.g., enlarge, use halo) the symbology for map readability while maintaining the essential design of the standard symbols. Map symbol colors, if applicable, will be maintained. The Planning Section Chief should be consulted if any alterations are being considered for use.

DWR/ICT MAP SYMBOLS, FROM APPENDIX C OF THE FIELD OPERATIONS GUIDE 2012

Administrative Symbols

- ICP — Incident Command Post
- B — Incident Staging Area
- H — Helispot
- T — Telephone
- CT — Cellular Telephone
- M — Meeting Area
- mph — Wind Direction and Speed
- First Aid Station

Access Route Symbols

- Unimproved Road
- Improved Road
- Blacktop Road

Problem Symbols

- Levee
- Levee Break
- Boil
- Overtopping
- Subsidence
- Erosion
- Seepage

Solution Symbols

- (A) (B) — Groups
- Riprap
- Visqueen
- Sandbag Wall
- Temporary Levee
- Relief Levee Cut

Supply Symbols

- Field Stockpile
- E — Empty Sandbags
- F — Filled Sandbags
- S — Sand
- V — Visqueen

Table 5.2 COMPLETE SET OF STANDARD MAP SYMBOLS FOR ICT

Symbol	Name	Description
Administrative Symbols		
	Incident Command Post	Location at which primary command functions are executed. The ICP maybe co-located with the Incident Base or other incident sites.
	Incident Staging Area	A location set up at an incident where resources can be placed while awaiting a tactical assignment on a three-minute available basis. Staging Areas are managed by the Operations Section.
	Helispot	A designated location where it is safe for helicopters to take off and land.
	Communications trailer	DWR Communications Trailer has satellite hookup and satellite phones for distribution to incident responders.
	Meeting Area	A location for holding Incident Command Team meetings.
	Wind Direction and Speed	The direction from which the wind originates. For example, An arrow facing south is a northerly wind blowing from north to south. Wind speed is the scalar magnitude.
	First Aid Station	A station providing emergency care or treatment before regular medical aid can be obtained.
Access Route Symbols		
	Unimproved Road	An unpaved road made from the native material of the land surface through which it passes.

	Improved Road	An unpaved road with a hard surface made by the addition of gravel.
	Blacktop Road	A road paved with asphalt.

Flood System Symbols

	Project Levee	A levee is an earthen structure built parallel to a river or stream. Levees are designed to prevent high water flows from inundating land. A Project levee is part of the State Plan of Flood Control.
	Nonproject Levee	A levee that is not part of the State Plan of Flood Control.

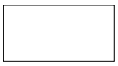
Problem Symbols

	Levee Break	A point in the levee system that has failed to perform its designed function has eroded away and is allowing water to inundate land.
	Boil	Also known as "sand boil," is caused by water flowing through or under a levee, possibly carrying eroded levee material, and surfacing on the landside of the levee.
	Overtopping	When water has risen higher than the banks of waterway or the top of a levee.
	Slope Instability (formerly called Subsidence)	The settling or sinking of an area of land.

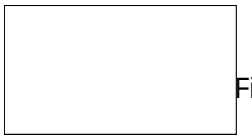
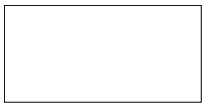
	Erosion	Removal of levee material from the toe or slope of the levee caused by swift moving water or wave action possibly resulting in bank caving, section loss, or levee break.
	Seepage	Water traveling under or through a levee in the void spaces of the soil.

Solution Symbols

	Boil Sack Ring	A method for controlling a boil by surrounding the boil with a watertight sandbag ring.
	Groups	The location of emergency response groups. Example groups are patrol groups and flood fight groups.
	Riprap	Rock used to armor shorelines and levees.
	Rain Coat (formally called Visqueen)	A single layer of plastic sheeting and sandbags used to protect slopes from further rain saturation.
	Sack Topping (formerly called Sandbag Wall)	A sandbag wall designed to prevent overtopping.
	Temporary Levee	Use of plastic sheeting, fill material and sandbags to raise a low area on a levee or embankment.

	Relief Levee Cut	Intentionally removed section of levee to relieve hydrologic pressure upstream and downstream of the levee section.

Supply Symbols

	Field Stockpile	Strategic location of stockpiled sandbags and other tools and equipment.
	Empty Sandbags	An 18”x30” bag (burlap or plastic) filled with sand or other appropriate material intended for use as a temporary flood fighting measure.
	Filled Sandbags	Stockpiles of sandbags that are prefilled with sand.
	Sand	The location of sand piles designated for flood fighting.
	Visqueen	Stockpiles of 100’x20’x10 millimeter plastic rolls.

CHAPTER 6 MAP PRODUCTS

PURPOSE

Standard Map Products are the maps frequently used during emergency response incidents. This chapter provides guidelines for the creation of GIS map products during an incident. Optional map definitions have also been developed for other GIS maps that are less regularly requested during an incident.

The objective was not to create an impossible standard, nor create a standard for every possible product. These “standards” are intended to be used as guidelines. Flexibility will need to be applied to these standards as the Planning Section Chief and other end-users may have specific needs or preferences. Map produced on an incident should communicate the intended message clearly. The most important criteria in preparation of a map product are the operational business drivers (i.e. primary use) for the cartographic products. The primary use should drive the focus of the maps, but once the operational period is over there may be other business drivers (i.e. secondary uses) that need to be considered.

One such secondary use relates to the archiving of data. Information from incidents must be archived as a historical record. Archive requirements may supplement the operational needs of the map to ensure that information on the map has adequate documentation. See chapter 7 of further guidance on archiving data and products.

STANDARD INCIDENT ACTION PLAN (IAP) MAP

Product Description: The IAP Map is the primary map used by Incident Command Team in completion of their mission and is a supplement to the Incident Action Plan.

Target Personnel: Incident Command Team

Objective: The IAP Map effectively communicates geographic feature relations and incident management objectives on an incident. The IAP Map is a tool used by operations staff to display field assignment, crew instructions, and division safety concerns at the operational period briefings and breakout meetings. The IAP Map is a tool for flood fight.

Guidelines

- Standard DWR Symbology
- Color choices Black and white to enable clear duplication
- Letter (8 ½" X 11")
- Generally 1:24,000 or 1:63,360 (1 inch = 1 miles)
- Prepared for operational period briefings

Required Elements

Cartographic

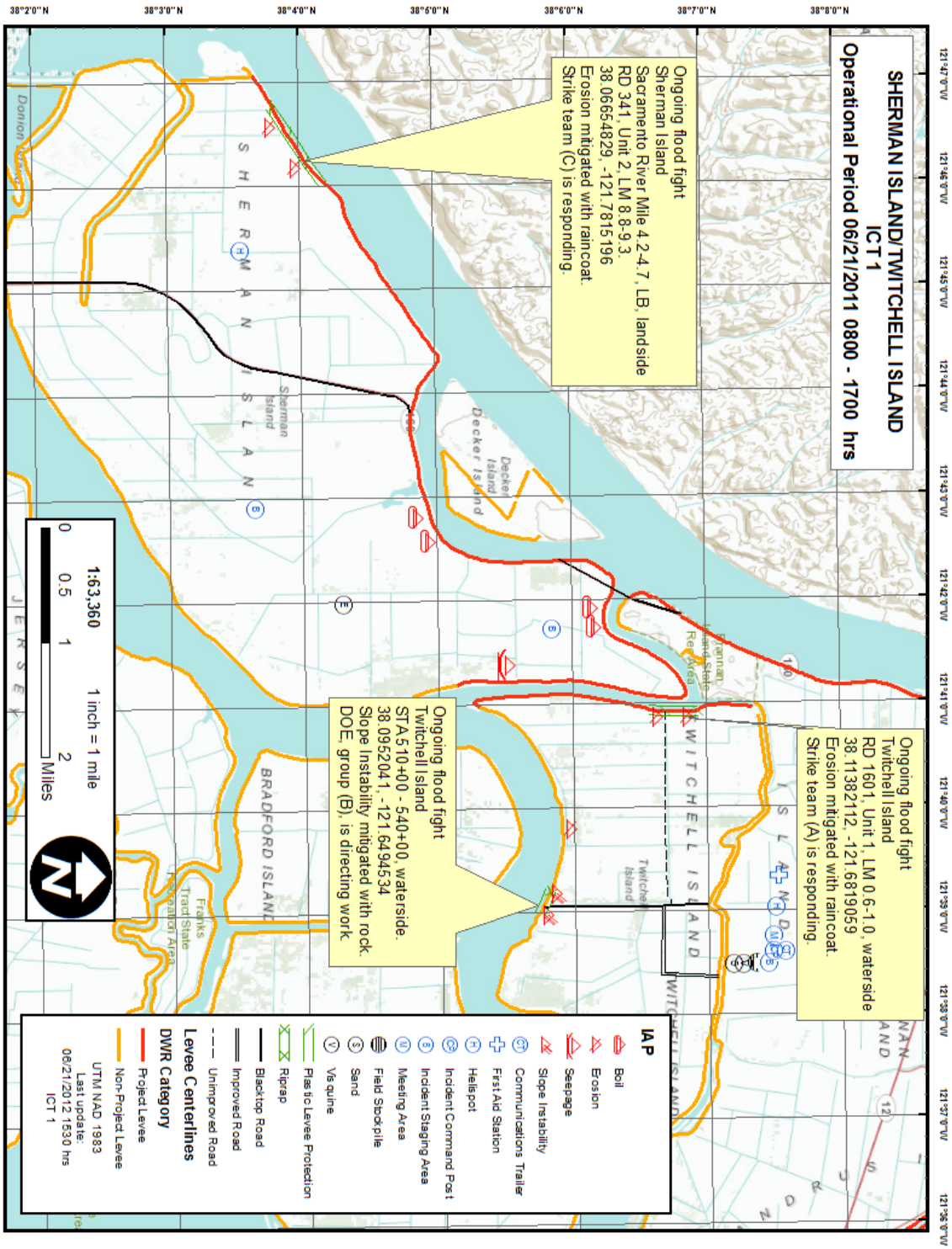
- STANDD (Scale, Title, Author, North Arrow, Date of Data, Datum)
- Date and time produced (small font for reference)
- Incident name and number
- Symbol legend
- Operational period (day-night)

Optional Elements

- Levee mile markers
- Administrative boundaries
- County boundaries

Data

- Incident Command Center (ICC), Incident Command Team (ICT) location
- Topography (USGS Topo, ESRI Topo)
- Imagery (optional if preferred above topography)
- Levee centerlines, stream gauges
- ICS features (ICT trailer, levee break)
- Geographic reference (usually latitude-longitude)
- Roads (unless already included on background topo map)



Example of an Incident Action Plan (IAP) Map, setup to print on 81/2” x 11” paper

STANDARD TRANSPORTATION MAP

Product Description: The Transportation map is small, planimetric map showing the access routes to the incident.

Target Personnel: Operations, logistics, crews, ground support

Objective: The Transportation Map provides an overview of the transportation network in the incident vicinity to support safe transportation. This map is used to facilitate land-based delivery of equipment, supplies, and personnel to and from the incident location.

Guidelines

- Standard DWR Symbology
- Black and white to enable clear duplication
- Letter (8 ½" X 11")
- Generally 1:24,000 or 1:63,360 (1 inch = 1 miles)
- Prepared for operational period briefings

Required Elements

Cartographic

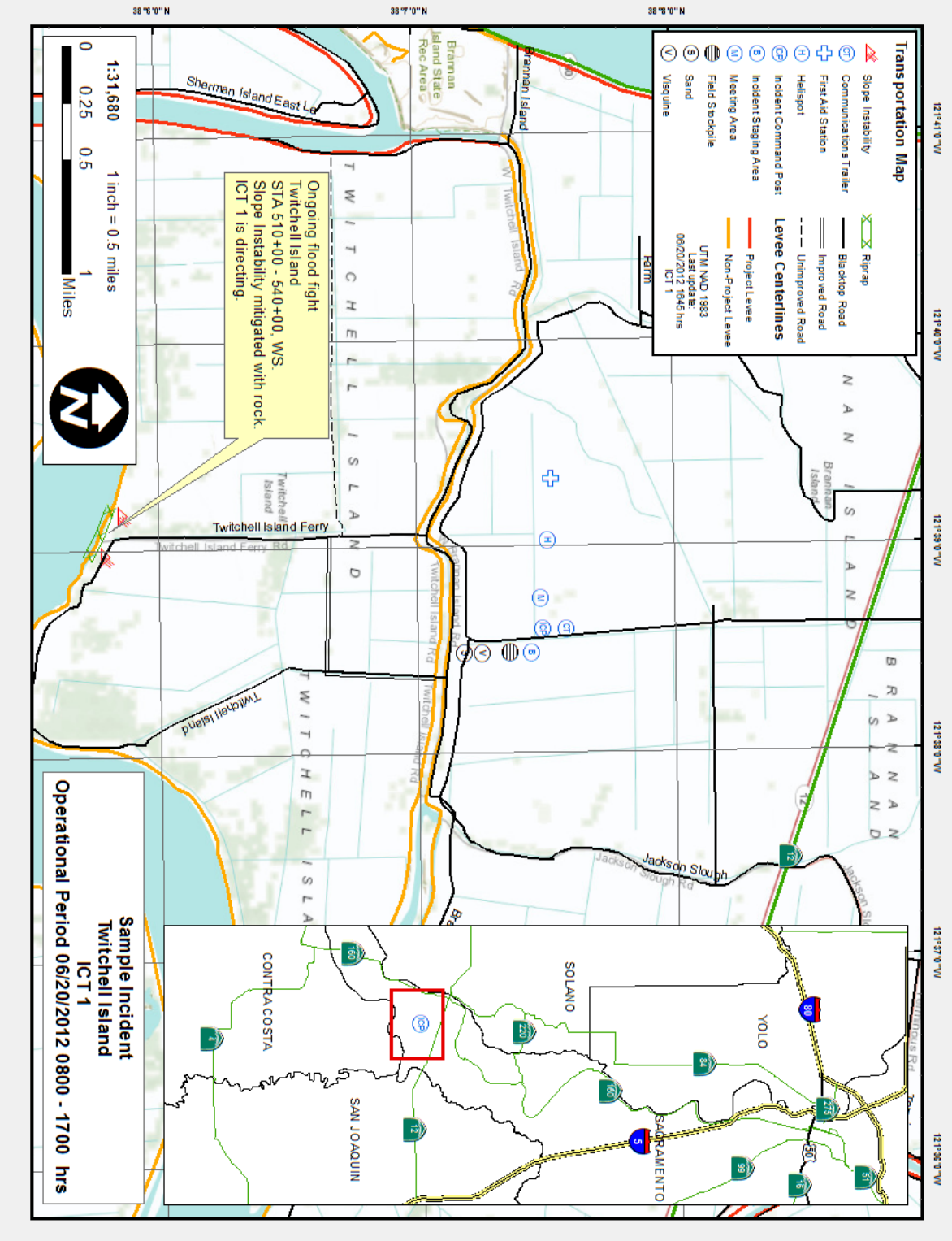
- STANDD (Scale, Title, Author, North Arrow, Date of Data, Datum)
- Date and time produced (small font for reference)
- Incident name
- Symbol legend

Optional Elements

- Levee mile markers
- Stream gauges
- Administrative boundaries
- County boundaries

Data*

- Area of concern (example: Twitchell Island)
- Hydrography
- Major roads, local roads
- Route restrictions (example: dirt road on private land)
- ICS features (example: ICT trailer, levee break)
- Geographic reference (usually latitude, longitude)



Example of a Transportation Map setup to print on 8 ½” x 11” paper

STANDARD INCIDENT BRIEFING MAP

Product Description: The Incident Briefing Map is large-format map of the incident area, which is used during briefings to discuss work assignments, and other details for the upcoming operational period.

Target Personnel: Plans Section Chief, Incident Commander, Operations Section Chief, Safety Officer

Objective: The Incident Briefing Map communicates sufficient incident detail to enable operations staff to brief personnel assigned to the upcoming operational period.

Guidelines

- Standard DWR Symbology
- Simple fonts and symbols, large enough to be read from the back of the briefing room
- Reduce clutter to enable clear communication
- "E" size (34" x 44") or larger

Required Elements

Cartographic

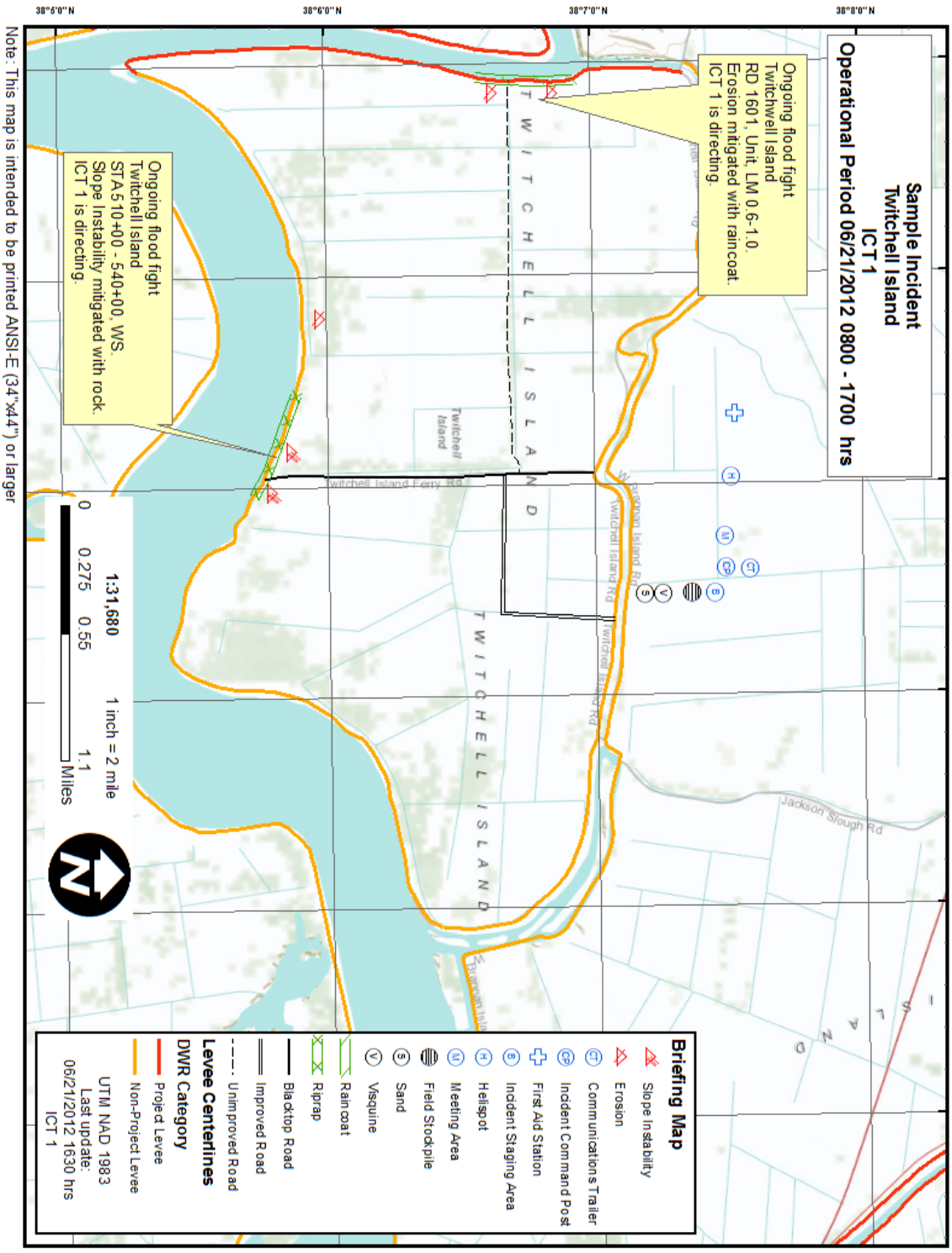
- STANDD (Scale, Title, Author, North Arrow, Date of Data, Datum)
- Date and time produced (small font for reference)
- Incident name and number
- Symbol legend

Optional Elements

- Safety Hazards
- Escape Routes
- Geographic reference (latitude, longitude, Public Land Survey)
- Administrative boundaries
- Stream gauges

Data*

- Incident Command Center (ICC), Incident Command Team (ICT) location
- Topography (USGS Topo, ESRI Topo, or imagery)
- Levee centerlines, stream gauges
- Major Transportation routes to incident
- ICC features (levee break, trailer location, aviation features)



Example of an Incident Briefing Map, scaled and set up to plot as ANSI E size (34” x 44”)

CHAPTER 7 DATA BACKUP, ARCHIVING, AND SHARING

PURPOSE

This chapter provides procedures for the sharing, backing up and archiving of GIS data developed on an incident. Data sharing ensures that all individuals involved on an incident have the information needed to do their job and that team transitions are effective and efficient. The purpose of backing up data is to ensure that the work of the GIS Specialist (GISS) is not excessively impacted by computer failures or data corruption and to protect incident data for the preservation of the incident record. The purpose of archiving data is to protect incident data for the preservation of the incident record while maintaining an efficient workflow in the GIS function of the Situation Unit.

SPECIFICATIONS

Incident data and incident base data layers that have been edited for the incident must be shared and archived. Export all incident data layers to shapefiles before archiving. This allows for compatibility of data among software vendors. Backups and archives should be stored on a computer or media that is kept separate from the working GIS directory.

The primary datasets that need to be shared daily are the incident status data layers. Post these on the designated DWR FTP site. Check with the DWR Flood Operations Center for the ftp address and instructions.

PROCEDURES

BACKWARD COMPATIBILITY CONSIDERATION

At the time of this writing, not all laptops designated for use on an incident have been upgraded to ArcGIS version 10, due to hardware limitations. The GISS should keep this in mind when creating and storing geospatial data files. Shapefiles are generally compatible across versions; geodatabases are not. In order to share a geodatabase with someone using an earlier version of ArcGIS, a copy must be saved to an earlier version. Map documents in the .mxd format created in version 10 cannot be opened in version 9.3, so the GISS should use “Save a Copy” to save the .mxd to be compatible with an earlier version if the map document is to be shared.

DATA BACKUP AND ARCHIVING

GIS data is in a digital format that requires constant maintenance. Part of this maintenance involves backing up and archiving the data. For the purpose of these guidelines, “backing up” refers to frequently saving a short-term, separate copy of incident data for the purpose of recovery in the event of computer failure or data corruption. The term “archiving” is used for the process of moving data to a separate data

storage device or media for long-term retention. Data archives consist of older data that are still important and necessary for future reference, as well as data that must be retained for regulatory compliance.

Data backups should be done daily, at a minimum, and should be stored on different hardware or media than the working GIS subdirectory. See the Guidelines section, below, for more specific information.

Data sharing involves a procedure at the end of the day or operational period. At the end of each operational period, GISS update the incident data and uploaded it to ftp.water.ca.gov or wherever the FOC directs you to upload for documentation.

File names must adhere to protocols established in Chapter 2. At the beginning of each flood season the DWR Flood Operations Center will issue the current upload sites and acceptable file formats.

GUIDELINES

(Refer to Chapter 2 for File Naming and Directory Structure.)

- Export incident data to shapefiles before any archive task; also archive the geodatabase
- At the end of each operational period, archive the incident_data, Incident_products, and incident_projects directories to a different location than the operational computer.
- Only dynamic datasets need to be archived. All base data should also be stored on media separate from operations systems.
- Data should be archived in formats that allow for quick recovery.
- Make an entry in the GIS Specialist log for each archive
- Hourly or simple backups can occur for datasets as they change.
- Provide a copy of the GIS Incident data archive to Flood Operations Center (FOC) GIS Analyst for safekeeping.

RESPONSIBILITIES

The GISS is responsible for posting updated data to the DWR FOC FTP site regularly, sharing data with other interested parties in consultation with the Planning Section Chief, protecting incident information with regular backups and archiving, and ensuring proper transition and use of data.

The GISS and Planning Section Chief are responsible for knowing which data layers are considered sensitive data and adhering to restrictions on the distribution and handling of such data.

COMMUNICATIONS

When asked for access to information (data, maps, etc.) the GISS is responsible for communicating these requests to the ICT Plans and Intelligence Chief to get the proper authorization to release the data to the requesting party. Handling of sensitive data is subject to restrictions.

DEFINITIONS

Archive – Archive is the long-term storage of data that are considered to be of value to the incident. It is held, independent of the continued existence of the file on your local drive. Archived files may be removed from the local disk on your computer, if required (for example, for space reasons).

Backup – Backup is intended to provide a mechanism for securing your ***current, active*** files; that is, files and data that are resident on your local disk and by implication actively in use. It enables you to recover your disk to its most recent state in the event that it is lost (for example, hardware failure): it also enables recovery a file or files that have been lost (for example, accidently deleted).

Data sharing – the process of distributing to other interested parties or agencies during the course of an incident or event. At the end of the incident/event, data are transitioned (Chapter 8).

Incident Data – Data that are created or edited in support of the incident.

Base Data – Existing data that are used to provide the base features for mapping (e.g., Roads, Land, Ownership, etc.). These data are not edited during the incident.

Modified Base Data – Base Data that have been edited in support of the Incident, but are not ICS data.

CHAPTER 8 TEAM TRANSITION

PURPOSE

This chapter provides the GIS Specialist (GISS) with an effective and consistent method of transitioning from one GISS to another. Providing the methods of work and direction ensures that all data, products, and other related information are transferred successfully.

SPECIFICATIONS

Transition of the GIS responsibilities refers to any hardware purchased for the Incident's GISS plus all relevant GIS data and media. It is important that all data are transferred and remain in their current directory (Chapter 2).

PROCEDURES

It is always important for the GIS Specialist to remain focused and follow procedures during this transition period.

The first procedure that must be addressed is transferring data from one storage device to another. It is critical to preserve the directory structure, drive letter mapping, or to follow Universal Naming Conventions (UNC) from one GIS Specialist to the next. Additionally, GIS Specialists should ensure that their ArcGIS is set to save relative paths.

GIS Specialists use a variety of media when operating on an incident. Storage devices range from basic shared drives on computers utilizing workgroups and shared portable hard drives to advanced computer networks utilizing switches, hubs, DJUCP and Snap Servers. Several transition methods can be used (Peer to Peer, DVD, external hard drives).

GENERAL GUIDELINES

- Before saving all final products, turn off all software extensions so that the final GIS documents can be opened with the basic installation of the relevant GIS Commercial Off-the-Shelf Software.
- Before data transfer begins, archive all incident data to portable media (CD or DVD).
- Document any unique characteristic of the data, along with the software (including version) and any tools being used
- Check for any sensitive information and what guidelines need to be satisfied for it to be transitioned to the next team. (This could include the need to reformat hard drives or any other media that will be leaving the incident.)

DOCUMENTATION USEFUL AT TRANSITION INCLUDES

- An image, hardcopy, and a list of each map type that has been produced on the incident, as an example of products produced.
- A short narrative describing the status of equipment, workload, work schedule, and other activities.
- A list of resources being used for mapping and data collection (Partner Agencies, DWR Engineers, Local Jurisdiction, etc.)
- If Incident Command authorizes use of nonstandard symbols on an incident, the GISS should include necessary documentation in the transition package to incoming GISS
- The outgoing GISS will provide map symbology information to the incoming GISS(s) or to Incident Command during the transition briefings. This facilitates consistency in the use of map symbols on an incident.

TO ENSURE TRANSITION IS COMPLETE, USE THE FOLLOWING CHECKLIST

- Are there enough GISS(s) and is workload appropriate?
- Are the incoming GISS(s) able to reproduce products produced by the exiting GISS(s)?
- Are there any outstanding requests from the local unit or other involved entities?
- Have the new GISS(s)established communication with the local unit to share data (e.g., local county emergency operations center)

RESPONSIBILITIES

It is the responsibility of the outgoing GIS Specialist to:

- Ensure that the incoming GIS Specialist have a clean, usable, and documented copy of the incident data.
- Communicate the requirements for storing, sharing, and displaying sensitive data.

It is the responsibility of the outgoing GIS Specialist and Plans Chief to:

- Ensure that the GIS staffing and equipment requirements are planned for and will be met during the transition

It is the responsibility of the outgoing GIS Specialist to:

- Test and verify that all data have been transferred successfully and are fully usable (access, read, and edit).

COMMUNICATIONS

All requests for maps should go through the Planning Chief. The Computer Specialists of the outgoing and incoming teams should be aware of the network, hardware, and software requirements of the GISS(s).

COMMON EMERGENCY MANAGEMENT ACRONYMS

CERT Community Emergency Response Team

CEM Comprehensive Emergency Management,

also Certified Emergency Manager

EAP Emergency Action Plan

EHS Extremely Hazardous Substance

EMA Emergency Management Agency

EMF Emergency Management Functions

EMS Emergency Medical Services

EOC Emergency Operations Center

EOP Emergency Operations Plan

ERP Emergency Response Plan

ERT Emergency Response Teams

ESF Emergency Support Function

FIRM Flood Insurance Rate Maps

FEMA Federal Emergency Management Agency

FIRESCOPE Firefighting REsources of Southern California Organized for Potential Emergencies

FOC Flood Operations Center

FY Fiscal Year

GIS Geographical Information System

HAZUS HAZards US

HAZUS-MH HAZards US-MultiHazard

IC Incident Commander

ICP Incident Command Post

ICS Incident Command System

ICT Incident Command Team

IDLH Immediately Dangerous to Life or Health

IMS Incident Management System

JIC Joint Information Center

LIDAR LIght Detection And Ranging

NIMS National Incident Management System

NOAA National Oceanographic and Atmospheric Administration

NWS National Weather Service

OSHA Occupational Safety and Health Administration

SOGs Standard Operating Guidelines

PIO Public Information Officer

USAR Urban Search and Rescue

USGS U.S. Geological Survey

VZ Vulnerable Zone

GLOSSARY

Attribute—non-spatial information about a geographic feature in a GIS, usually stored in a table and linked to the feature by a unique identifier.

Backup—a copy of one or more files made for safekeeping in case the originals are lost or damaged.

Coordinates—a set of values represented by the letters x, y, and optionally z or m (measure), that define a position within a spatial reference. Coordinates are used to represent locations in space relative to other locations.

Coordinate System—a reference system consisting of a set of points, lines, and surfaces, and a set of rules, used to define the positions of points in space in either two or three dimensions.

Datum—the reference specifications of a measurement system, usually a system of coordinate positions on a surface (a horizontal datum) or heights above or below a surface (a vertical datum).

Declination [magnetic]—the horizontal angle between geographic north and magnetic north from the point of observation.

Differential Correction—a technique for increasing the accuracy of GPS measurements by comparing the readings of two receivers—one roving, the other fixed at a known location.

Digitize—to convert the shapes of geographic features from media such as paper maps or raster imagery into vector x, y coordinates.

Documentation—tracking information about geospatial data using methods that are less than FGDC compliant. These may include “ReadMe” files (in TXT or HTML format) or attribution of datasets describing the projection, methods of collection, contact information, and other information.

Dongle [sentinel key]—the sentinel key is a parallel or USB port hardware dongle that provides a unique number used in the generation of a licenses. The sentinel key will return its number only when the sentinel key and the sentinel key driver are communicating properly.

Esri- Environmental Systems Research Institute. Esri develops geographic information systems (GIS) (e.g., ArcGIS). Synonymous with the acronym ESRI.

Feature—(1) an object in a landscape or on a map; (2) a shape in a spatial data layer, such as a point, line, or polygon, that represents a geographic object.

File Geodatabase— a database or file structure used primarily to store, query, and manipulate spatial data (geometry, spatial reference system, attributes, and behavioral rules. Stored as folders in a file system. Each dataset is held as a file that can scale up to 1 TB in size.

Geodatabase—a database or file structure used primarily to store, query, and manipulate spatial data (geometry, spatial reference system, attributes, and behavioral rules).

Graticule—a network of longitude and latitude lines on a map or chart that relates points on a map to their true locations on the earth.

Incident Command System (ICS) Data – primary information about the flood event itself and features or locations directly pertinent to the management of the incident.

Latitude—the angular distance along a meridian north or south of the equator, usually measured in degrees. Lines of latitude are also called parallels.

Longitude—the angular distance, expressed in degrees, minutes, and seconds, of a point of the earth's surface east or west of a prime meridian (usually the Greenwich meridian). All lines of longitude are great circles that intersect the equator and pass through the North and South Poles.

Map Scale—the ratio or relation between distance or area on a map and the corresponding distance or area on the ground.

Metadata—information about data, such as content, source, vintage, accuracy, condition, projection, responsible party, contact phone number, method of collection, and other characteristics or descriptions.

Orthoimagery—a digital perspective aerial photograph from which distortions owing to camera tilt and ground relief have been removed. An orthophotograph has the same scale throughout and can be used as a map.

Personal Geodatabase—a database or file structure used primarily to store, query, and manipulate spatial data (geometry, spatial reference system, attributes, and behavioral rules. Datasets are stored within a Microsoft Access data file, which is limited in size to 2 GB.

Projection [map]— A method by which the curved surface of the earth is portrayed on a flat surface. This generally requires a systematic mathematical transformation of the earth's graticule of lines of longitude and latitude onto a plane. Every map projection distorts distance, are, shape, direction, or some combination thereof.

Remote Sensing—collecting and interpreting information about the environment and the surface of the earth from a distance, primarily by sensing radiation that is naturally emitted or reflected by the earth's surface or from the atmosphere, or by sensing signals transmitted from a satellite and reflected back to it. Examples of remote sensing methods include aerial photography, radar, and satellite imaging.

Shaded Relief Image—a raster image that shows light and shadow on terrain from a given angle of the sun.

Shapefile—a vector file format for storing the location, shape, and attributes of geographic features. It is stored in a set of related files and contains one feature class.

Server—a computer and storage device dedicated to storing files. Many users on a network can store files on a particular server.

Topography—the shape or configuration of the land, represented on a map by contour lines, hypsometric tints, and/or relief shading.

Universal Naming Convention (UNC) - a naming convention used primarily to specify and map network drives in Microsoft Windows. UNC names consist of three parts - a server name, a share name, and an optional file path. These three elements are combined using backslashes as follows: \\server\share\file_path

USB External Storage Drive—an external disk drive that is connected to a computer through a USB connection.

REFERENCES

DWR FLOOD FIGHTING METHODS July 2009
Department of Water Resources, Division of Flood Management, Flood Operations Branch

DWR INCIDENT COMMAND SYSTEM Field Operations Guide 420-1 Revision 2012
State of California Department of Water Resources Division of Flood Management

Flood Emergency Operations Manual, February 2002
State-Federal Operations Center, Department of Water Resources

GIS Standard Operating Guidelines on Incidents, June 2006
National Wildfire Coordinating Group, PMS 936, NFES 2809

GIS Standard Operating Guidelines on Incidents, DRAFT Field Review, April 2012
National Wildfire Coordinating Group, PMS 936, NFES 2809

APPENDIX A: LIST OF NECESSITIES FOR RESPONDING TO AN INCIDENT

Personal

____ Boots, rain gear, hat (your own or check with your Planning Section Chief)

____ Change of clothes (wool socks, pants, and shirt)

____ Hygiene (toothbrush, soap)

____ Food and water i.e., power bars, water bottle

____ Sleeping bag, pillow

Professional

____ Computer, thumb drive, VPN token for the incident (Check with the Planning Section Chief)

____ External GIS Datasets (issued by the Flood Operations Center)

____ GIS Toolbox containing preprinted map books and other reference materials (issued by the Flood Operations Center)

____ General Office Supplies Box: pens, pencils, printer paper (Check with your ICT or bring your own)

APPENDIX B: CALFIRE'S TIPS FOR COLLECTION OF GPS DATA ON INCIDENTS

This document contains information on how to use a Garmin GPS to record data on an incident. It includes: a list of things to consider when using a GPS on incidents; how to properly setup a GPS; and instructions on collecting track and waypoint data.

I. Considerations When Collecting GPS Data on Incidents Using GIS Mapping

A. Contact GIS staff prior to going out and collecting data.
   1. In most cases, they can ensure that the GPS is set up properly.
   2. They will need to know if you are using a non-Garmin GPS unit – might not be able to download.
   3. Advise the GIS personnel if you are not using a Garmin GPS, but have software to download the unit. They can usually work with the data if they have the time.
   4. With the Situation Unit Leaders approval, the GIS personnel can inform you where there are gaps in their perimeter data. You can then use your GPS to record this data.
   5. If available, you might be able to get better, large format maps from the GIS staff.

B. Manage personnel collecting GPS data on incidents.

   1. Assign data collectors to specific areas.
   2. Make sure the boundaries of each area are defined.
   3. Don't overlap areas. Duplicating data from several people becomes very confusing to GIS staff if notes differ.
   4. If fire is multi-jurisdictional, contact other agencies to see if they are collecting data.
      a) This will reduce the chance of duplicate data collecting.
      b) Work together and share data for better data collection efficiency.
      c) Ensure that all personnel use the same data and documentation standards.
      d) Federal agencies will usually have the fire flown to take aerial photos to capture current digital images.
         1) These can be very useful when printed and analyzed.
         2) Can be used to decide where to send personnel to collect data.

C. Always take your GPS download cable to incidents. Keep it with the GPS.

D. It's good to have an external antenna to use when recording GPS data while driving or flying on the incident.

E. Take field notes to document the GPS data as you collect it.
   1. Don't wait until the end of the day to write your notes. It either won't happen or your memory will be very sketchy.
   2. Record the GPS time when you start and stop recording track data. The GIS personnel can use that information to identify track data once it is downloaded.

3. Can develop pre-made tables to record notes.
4. Photos can be used in addition to notes.
    a) Especially good for rehab and damage assessment.
    b) Usually required for damage assessment.
    c) Digital photos are good for documentation.

F. When recording waypoints, average the points for better accuracy, especially in heavy canopy cover. Some Garmin GPS models are not capable of averaging. See Part IV of this document for instructions.

G. When recording track data with the GPS:
1. Always clear the **Active Track** before you start recording data so that old data that was already downloaded is not mistaken for new data.
2. It's preferable to set the **Record Mode** in the Track **Setup Logging** window to **Fill**, the **Interval** to **Distance** and the **Distance Value** to **0.01 miles**. This will record a track point every 53 feet.
    a) Do not set the Record Mode to Wrap. This will cause the GPS to overwrite track points at the beginning of the track if GPS memory hits 100%. It wraps back around to the starting point and deletes the points starting with the first point. It will continue overwriting track points until you stop tracking.
    b) If the Interval is set to Time, when you stop to talk to someone, the GPS will continue to record. This does not occur when GPS is set to Distance.
    c) Some GPS units have a Resolution setting that will allow you to set your distance interval down to 1 foot.
3. Don't turn GPS off to stop recording a track segment.
    a) Instead, go to the Track **Setup Logging** window and switch the **Record Mode** to **Off**.
    b) This will help avoid collection of unnecessary track points when the GPS is turned back on.
    c) It's very difficult for the GIS personnel to interpret this data if erroneous data is captured.
4. Know how many track points your GPS is capable of storing. This will help you determine how many miles you can record.
    a) GPS III Plus – 1900
    b) GPS 12XL – 1024
    c) eTrex – 1536
    d) eTrex Legend series – 10,000 w-latest update
    e) eTrexVista series – 10,000 w-latest update
    f) GPS V – 3000
    g) GPSMap 76S & 76CS – 10,000 w-latest update
    h) GPSMap 60 series – 10,000

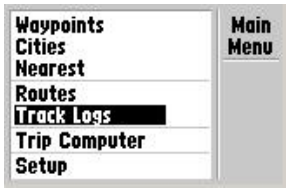
5. **DO NOT save the Active Track to a Track Log**. If there are more than 100 (750 in Legend, Vista and GPSMap 76S) track points in the Active Log, this will average it down to 100 (750 in models noted above) points in the Track Log. This will ruin your accuracy.
6. **DO NOT** back track where you have already recorded data. This will make a mess when the data is loaded into the GIS software.
    a) Turn the Record Mode to Off if you need to veer off your intended course.
    b) Flag where you stopped recording.
    c) When you are ready to resume recording, turn the Record Mode to Fill, and continue on your course.

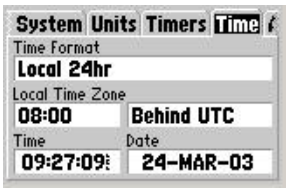
H. If you will be using a helicopter to GPS the fire perimeter:
1. Observe all safety measures given during pre-flight briefing.
2. Keep an eye out for and advise pilot of any hazards while flying (other nearby aircraft, power lines, towers, rock outcrops, etc.).
3. It's best to use the suction cup antenna on the front window (roof window if available).
4. Make sure that the GPS is turned on and has gotten 3D position before taking off.
5. It's good to ask the pilot if (s)he has ever GPS mapped a fire perimeter before taking off.
    a) If pilot has flown GPS missions before, ask if they enjoy doing it.
    b) If not, you might find another ship to use if available. That person will probably fly it so fast that you get very poor perimeter data.
6. Prior to takeoff, discuss method of flying along perimeter.
    a) Discuss terminology to use while in flight (start, stop, pause, break, etc).
    b) Clock-wise verses counter-clockwise flight around fire.
    c) Flying low and slow is best.
    d) Discuss what you want them to do when you encounter narrow pockets along perimeter.
    e) Have pilot advise if they need to break away from the perimeter (to gain altitude, avoid sudden obstacles, etc.).
7. Maintain good communication with pilot while flying. Usually (s)he will want your help to find and keep on the perimeter.
8. If flying along fire perimeter where the fire is contained, but the burn is still hot, make sure the copter rotor wash doesn't blow hot embers across the fire line. Advise pilot to increase altitude and speed to prevent this from occurring.

II. GPS Setup for Collecting Data – All pictures of GPS menus in this document are from a Garmin GPS III Plus. Most Garmin GPS models have similar menus.

A. Set up your GPS prior to going out on the fire line.

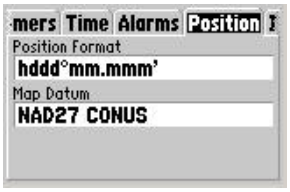
B. Set time to 8 hours behind UTC in Pacific standard time zone. During daylight savings time, use 7 hours.



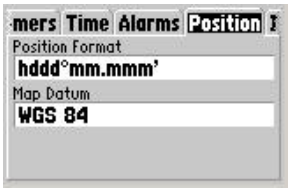


C. Set the Map Datum based on intended use of GPS unit. This sets the datum used for coordinates as they are displayed on the GPS unit

1. Use **NAD27 CONUS** when using GPS coordinates to find a location on USGS quad maps.



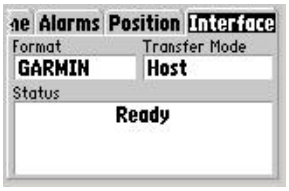
2. Use **WGS 84** datum (~300 foot horizontal deviation from NAD27 CONUS) when working with aircraft. Change to this datum when giving aircraft your coordinates.



3. Regardless of what you have your GPS Map Datum set to, it always downloads in WGS84 datum. This is the format used by most map software.

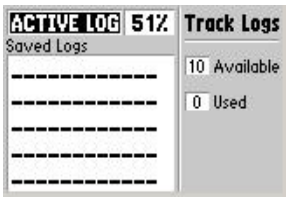
D. Set Position Format to **hddd°°mm.mmm'** as shown above.

E. Set Interface Format to **Garmin** and Transfer Mode to **Host**.



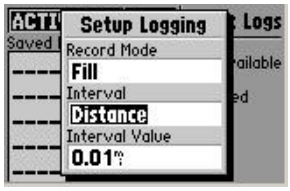
III. Use the Following Process to Record Track Data:

1. Press the **Menu** button twice to open the main menu. Use the center rocker button to scroll down to **Track Logs** then press the **Enter** button.



2. The Active Log window will open. This window displays saved track logs and the amount of Active Log storage used.

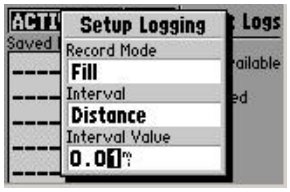
3. Press the **Menu** button to open the Track Menu. Scroll down to **Clear Active Log**. Then press the **Enter button** to delete any track points currently stored on the GPS.



4. Next, select **Setup Logging** and press the **Enter** button to open the Setup Logging window. Set up your GPS to the settings displayed to the left. This will record a track point every 53 feet.

5. To set the **Record Mode**, scroll down until the item in this window is selected. Then press the **Enter** button. Select **Fill**, then press the **Enter** button.

6. Set the **Interval** to **Distance** using the same method as above.



7. Set the **Interval Value** to **0.01 miles**. This will be approximately 53 feet between track points. Using a GPS III plus, you can collect ~19 miles of track data at this setting.

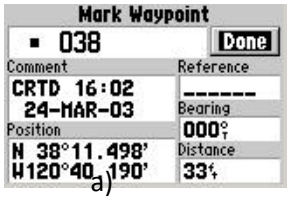
8. Before getting to the location that you would like to start recording, set the **Record Mode** to **Off** (Step 5, but set to Off) and then **Clear Active Log** (Step 3). Doing this will prevent collecting unwanted track data.

9. When you are at your starting point and ready to start recording track data, set the **Record Mode** to **Fill** (Step 5). Leave the **Setup Logging** window open with the **Record Mode** menu open as the GPS is recording. If you need to stop recording, you can quickly set the **Record Mode** to **Off**. Take note of the time that you started recording and describe the data that you are collecting.

10. When you are at the location where you would like to stop recording, set the **Record Mode** to **Off**. Take note of the time that you stopped recording.

11. Go to the next location where you want to record data and repeat Steps 9 and 10.

IV. Use the Following Process to Create and Average a Waypoint



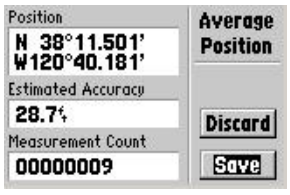
a)

1. **Not** all Garmin GPS models have this capability.

2. To record a Waypoint, press and hold down the **Mark** or **Enter** button until the **Mark Waypoint** window appears.

3. If you don't want to average the waypoint, press the **Enter** button again to save the waypoint. Go to 4 if you want to average the waypoint.

4. In **Mark Waypoint** window, press the **Menu** button to open the **Mark Waypoint Menu**. Then select **Average Position** and the **Enter** button.



5. The **Average Position** window will open and start collecting points to calculate the average position. Collect at least 20 points as noted in the **Measurement Count** window. Then press the **Enter** button to save it.

6. When the **Mark Waypoint** window appears, **Done** should be selected. Press the **Enter** button to record the waypoint.

7. Write the waypoint number and a description of the waypoint in the field notes.

V. Updating GPS Software

Garmin updates the GPS software for the various GPS models on a routine basis and it's good to regularly check their website for updates. The updates include: fixes to problems and software bugs; increase the capabilities and/or functionality of the GPS; update technology changes in satellite communications with unit; and many other feature changes. The updates and the installation instructions for the various GPS models can be downloaded from the Garmin website at http://www.garmin.com/support/download.jsp. Following the instructions, you can then upload the software update directly to the GPS unit.

APPENDIX C: HELPFUL TIPS

How to create a shapefile from XY coordinates using Excel and ArcMap

1. Open ArcMap.
2. Go to File -> Add Data -> Add XY Data.
3. In the "Add XY Data" dialog box, browse to your Excel file (can be in Excel 97-2003, 2007, or 2010), and select the worksheet that contains your table of coordinates.
4. The X Field should be Longitude and the Y Field should be Latitude.
5. If you know the spatial reference of the input coordinates, click the "Edit..." button and select it, then click OK.

   FOR EXAMPLE, IF YOUR COORDINATES ARE BASED ON A WGS84 GEOGRAPHIC COORDINATE SYSTEM: CLICK THE "EDIT..." BUTTON, THEN THE "SELECT..." BUTTON, GEOGRAPHIC COORDINATE SYSTEMS -> WORLD -> WGS 1984.PRJ -> OK.

   If you do not select a spatial reference, the shapefile may have an Unknown Coordinate System, or take the incorrect one from the data frame's properties.

6. The coordinates should plot as a point event theme. Note that it is not a shapefile, just an event theme. To create a shapefile from the event theme, right-click the layer in the TOC and select Data -> Export Data.... Then select a location for the new shapefile, name it and click OK.

TIP: Make sure that coordinates South of the Equator and West of the Prime Meridian are negative, or your points will plot in the wrong hemisphere!

This workflow is copied from the University of North Carolina, University Libraries Research and Instructional Services Department website: http://www.lib.unc.edu/reference/gis/faq/xy.html

APPENDIX D: EXPORTING MAP TO GEOREFERENCED PDF FORMAT

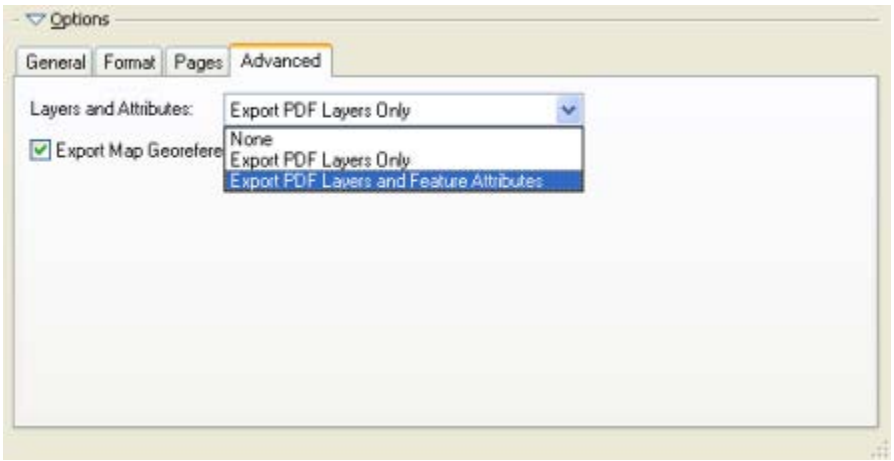
Maps created in ArcGIS can be exported to pdf documents that contain layer visibility and georeferencing options. This allows geospatial information to be viewed on a computer that does not have ArcGIS software installed. For best results, Adobe Acrobat 9 or later or Adobe Reader 9 or later are the recommended applications for viewing georeferenced pdf maps.

For a detailed description of exporting to a georeferenced pdf map please refer to this article on the ArcGIS Resource Center website:
http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//00sm00000004000000.

The following is an excerpt from the referenced help article:

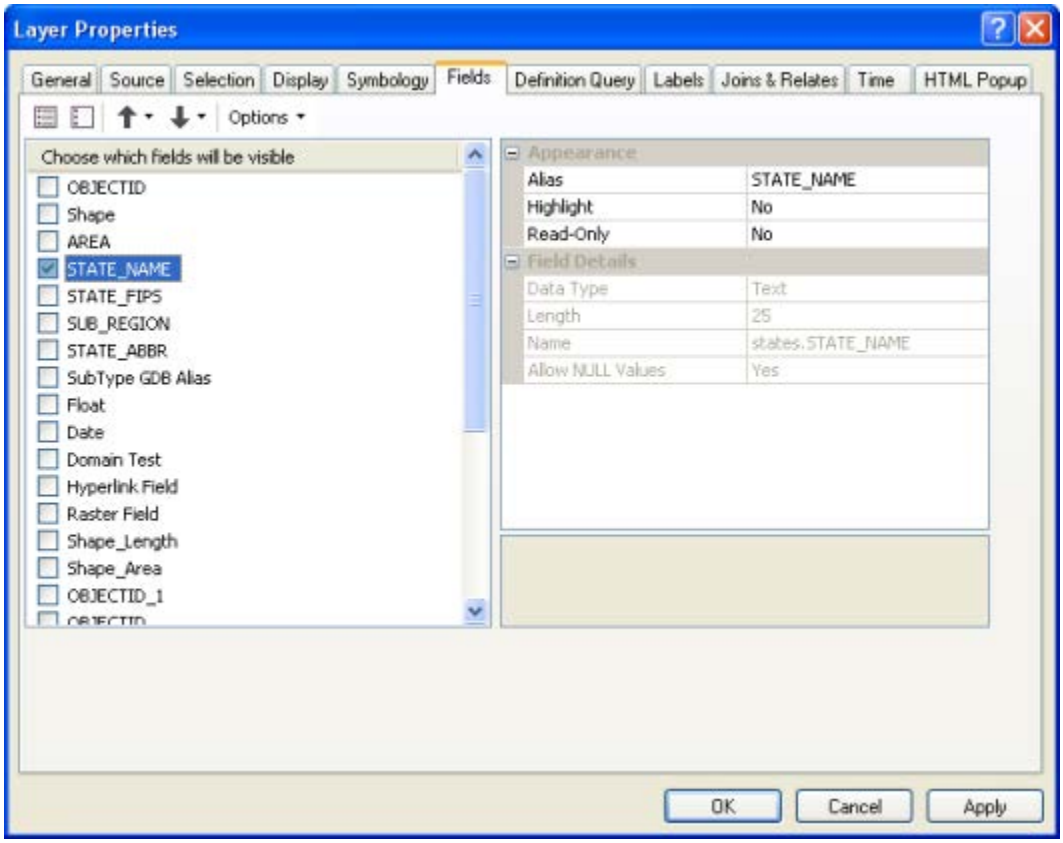
PDF ATTRIBUTES

PDF files exported from ArcGIS can include feature attributes from the feature's attribute table using functionality built in to Adobe Acrobat and Adobe Reader. This option can be enabled by choosing the Export PDF Layers and Feature Attributes option from the Advanced tab of the Export Map dialog box:



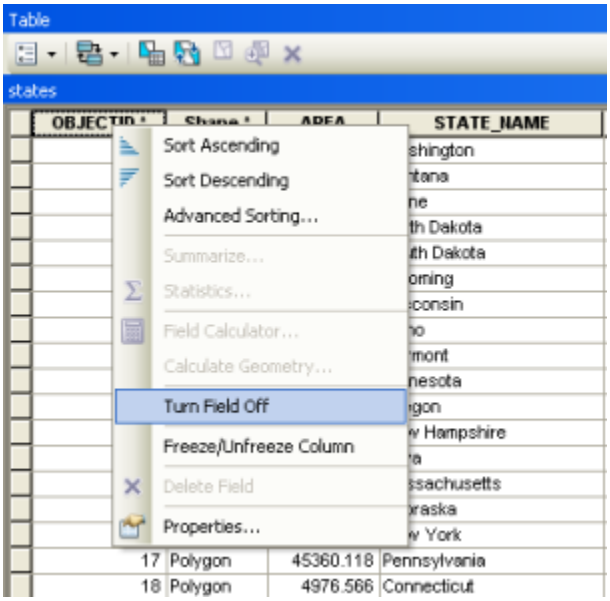
The Export PDF Layers and Attributes option enables both PDF layers and the export of attributes based on options chosen in the Fields tab of the Layer Properties dialog box.

The visibility of fields in the feature's attribute table determines what fields will be exported in the resulting PDF. To turn these fields on and off, go to the Fields tab of the Layer Properties dialog box. The check boxes determine the visibility of the given field. Check or uncheck the check boxes to expose more or fewer attributes in the resultant PDF.



The Fields tab on the Layer Properties dialog box showing visibility of attribute table fields

Alternatively, the visibility of the fields can be controlled in the Table window by right-clicking the column heading and choosing the Turn Field Off option:



The Turn Field Off shortcut menu option also toggles field visibility, disabling its export in the PDF attributes.

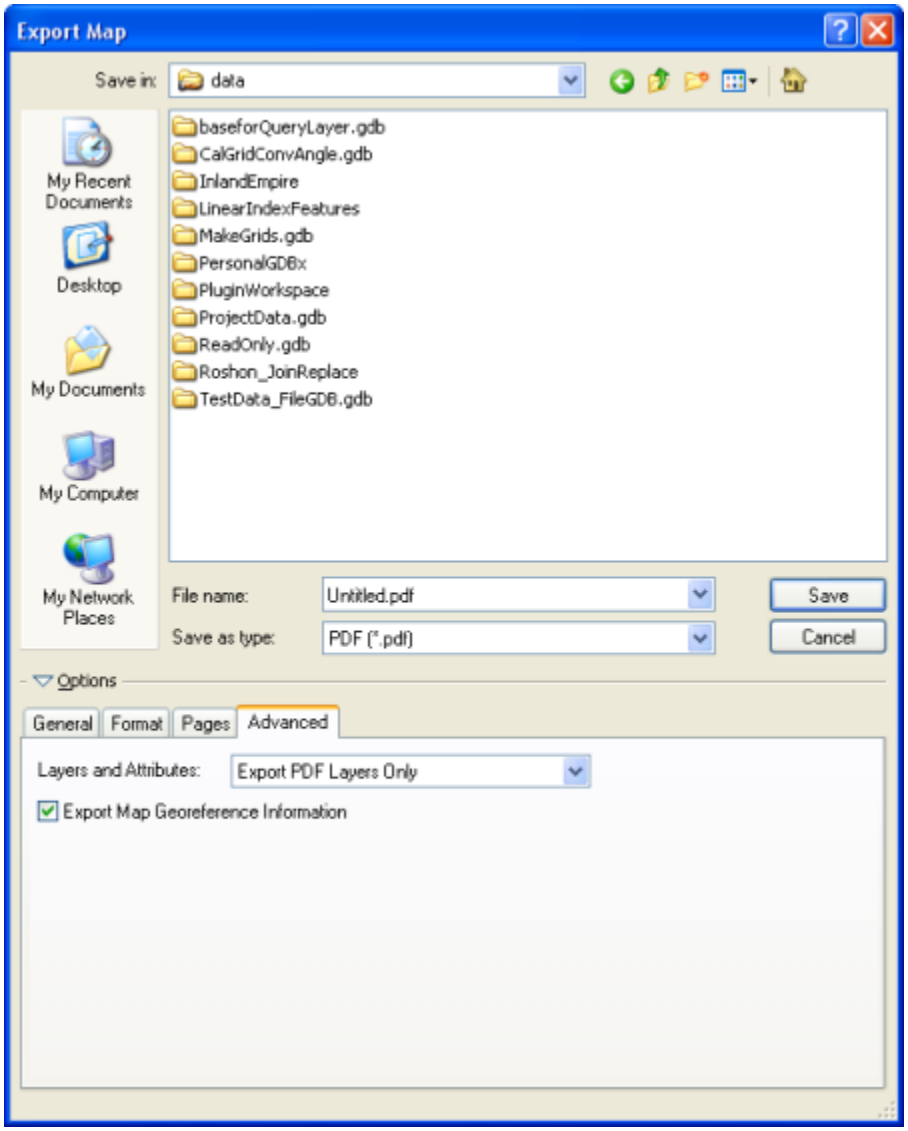
Caution:

Exporting attributes to PDF can result in performance problems in compatible PDF viewers. If possible, limit exported fields to one layer per map. To suppress field export, turn off field visibility in the Layer Properties dialog box.

People using your PDF can access these attributes in Adobe Acrobat and Adobe Reader using the Object Data tool (see Tools > Object Data, or enable the Model Tree view in either of those programs).

PDF MAP GEOREFERENCE

Adobe Acrobat and Adobe Reader versions 9 and later allow viewing of map coordinates and georeference information encoded inside the PDF file. Exporting a map with the Export Map Georeference Information option enabled will record each data frame's georeference information inside the PDF. When the georeferenced PDF is opened in a compatible viewer, such as Adobe Reader 9, the user can access geospatial functions such as coordinate readout and finding x,y.



The Export Map Georeference Information check box on the Advanced tab of the Export Map dialog box

2/16/2012

http://help.arcgis.com/en/arcgisdesktop/10.0/help/00sm/00sm00000007000000.htm