MODULE 12: MAPPING

Key Concepts:

- Maps for Master Plans
- Cost Effective Data and Software
- Map Layout Standards
- Map Creation
- Programmatic Approach to Mapping

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Maps for Master Plans

Why are Maps important in Master Plans?

- Clearly show management areas described in text
- Display Corps lands in the context of the surrounding area
- Show trends in land use, urbanization, and changing demographics over time
- Serve as a visual display of land classifications

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Maps/Plates to be Included in a Master Plan

Project Overview

- Allocation Map (if there are multiple allocations)
- Classification Maps

Optional

- Utility Corridors
- Zone of Interest
- Surrounding Demographics
- General resource maps – soils, tree canopy, etc

Area Maps

- Recreation Areas (Park Plates)

Optional

- Site maps for areas that aren't high density recreation, but still of interest (primitive camping, trails, special management, etc.)

***Focus on maps that help clarify and describe the Master Plan text**

*** Use maps from the previous MP version as guides for maps to include/update in the MP Revision**

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Cost Effective Data and Software

Data

- The Master Plan is a land use management document. Data does not need to be survey-grade accurate to clearly convey project information
- Seek out as much existing data as possible before creating new information

Software

- Use software and mapping systems that are already available to the Corps without incurring additional cost
- Verify that software is compatible with USACE computer security requirements

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Available Software

ESRI Software

- ESRI's ArcGIS is the industry standard for mapping software. While somewhat complex to learn, training modules are available through the software company by contacting your district GIS POC. ESRI products offer tools for creating good quality map products for documents
- ESRI also has products and online systems that can share information and draft map versions easily

Google Mapping Systems

- Google map systems are a popular source for web-based mapping functions. Google provides an ever-growing set of tools (and help features) , which makes the systems increasingly usable without much GIS experience
- Could be a useful tool for displaying data for public meetings and public review

VERS Modernization Map System

- As the VERS Modernization Mapping System continues to evolve, spatial data and map viewers will offer increasingly more information that can be used in a Master Plan Revision or Supplement

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Corps Data Sources for Mapping Content

- Use a programmatic approach to mapping and look to **existing data** sources within the agency to avoid duplication of effort.
- Creating a spreadsheet of data needs and availability during the planning phase will help identify expected costs and labor moving forward

VERS Mapping Exercise

- Displays approximate recreation area boundaries
- Includes numerous site map features
- Integration of data into Google Earth

Level One Inventories

- GIS is a tool to easily complete inventories
- Same dataset used in MPs visually describes land use, tree density, etc.

Real Estate Data

- Property boundaries
- Lease area boundaries for outgranted recreation areas and wildlife management areas

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Other Agency Data Sources for Mapping Content

Topic	Data Source(s)
Roads	U.S. Census TIGER data, ESRI Roads
Aerial Photos	ESRI Basemaps included with software State GIS offices, USDA Army Geospatial Center
Wetlands	US Fish & Wildlife Service National Wetlands Inventory (NWI) www.fws.gov/wetlands/
Tree Canopy Cover	Multi-Resolution Land Characteristics Consortium (MRLC) www.mrlc.gov
Land Use	Multi-Resolution Land Characteristics Consortium (MRLC) www.mrlc.gov
Watershed Boundaries	USGS National Hydrography Dataset (NHD) nhd.usgs.gov
Soils and Geology	NRCS Data Gateway datagateway.nrcs.usda.gov
Ecoregion Boundaries	Environmental Protection Agency www.epa.gov/wed/pages/ecoregions National Atlas www.nationalatlas.gov
Demographics	U.S. Census TIGER data, State Offices, ESRI map services
Economics	U.S. Census TIGER data
Additional information	State offices often offer an online GIS data “warehouse” with downloadable information specific to the state. Types of data available vary greatly between states

Map Standards

Using **geographic information systems (GIS)** for landscape data processing and cartographic products can greatly **enhance the availability of information** and the **ease of displaying and conveying the information** to the readers.

- Make map documents easily readable and consistent throughout each district.
- Standards for layout templates and symbologies can be developed by each district
- General style guidelines and suggestions are provided in the subsequent slides
- Goal of standardizing maps is to give the documents a branded appearance and consistent presentation of information throughout the Project's and District's planning documents

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Map Standards

Cartographic Standards

- Creating a map layout that can be used as a template for all maps in the document– saves time and streamlines the look of map documents

Symbology Standards

- Helps the reader quickly understand map documents and saves time in map creation – ideally same symbols across all district maps

Data Stands

- Good data management and file structure practices save time and make using the data easy

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Map Standards

Elements of a Printed Maps

- Header/Title
- Map
- Map Elements
  - ►Scale bar
  - ►North Arrow
  - ►Legend

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Elements of Printed Maps – Header/Title

Maps are often copied out of documents, make sure that these minimum elements are on the map page and not only in the document the map may accompany.

The header or title of a map should reflect minimum essential information about the map:

- Main theme and the date (date of imagery is also important, if used)
- Location information (country and region/area)
- Short clear description of the thematic content

Required Title Elements

- **Logo** – USACE castle logo (in accordance with USACE graphics standards, EP 310-1-6)
- **Map title** – San Serif font type, usual bold

Optional Title Elements

- **Subtitle** – San Serif font type
- **District and Project Name** – San Serif font type
- **Date of map content** - San Serif font type

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Elements of Printed Maps – Map

The map image is the most important part of the page and should take up the most possible space. It should be clear with minimal obstructions from the legend or other map elements

Color choice should be considered carefully as it may need to be printed in both black and white as well as color. Also consider the display medium of the map, and that printed colors will appear different than on the screen. Test and make sure the resolution and color choices are good both on screen and on paper

Requirements:

- **Border** - placed around the map extent; try to line it up with the Header/Title

Guidelines:

- **Grid use** – best to be used over a large regional scale as opposed to a smaller project area
- **Aerial imagery and topographic base maps -** may be useful in displaying an area of interest; however, make sure the image adds value to the message you want to communicate. Many images obscure the symbols or map themes on the map,
which may distract from the message you wanted to deliver

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Elements of Printed Maps – Labeling Guidelines

Labeling map features – The goal of feature labels is to be easy to read, limited variation on fonts and text sizes, used consistently in all maps in the document, and allow the map to easily convey information to the reader.

Consider some of these examples from ESRI:

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Elements of Print Maps – Labeling Suggestions for Readability

Recommended Minimum Text Sizes

Viewing Distance (feet)	Computer Screen (points)	Printed Maps (points)	Computer Screen (inches)	Printed Maps (inches)
1.5	8	6	0.11	0.08
2	11	8	0.15	0.11
3	16	12	0.22	0.17
5	27	20	0.37	0.28
10	53	40	0.74	0.56
20	107	80	1.48	1.12
30	160	121	2.22	1.68
50	266	201	3.70	2.79
100	533	402	7.40	5.59

Table from ESRI

Takes into consideration the distance at which your maps and documents will be viewed. Text should be easily read by the viewer. While a 8pt size text will be legible in the Master Plan document, the same size elements will not be easily viewed on a poster-sized map for a public meeting. Make adjustments so maps are easily understood.

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Printed Map Elements

The contents of the remainder of the map document are meant to inform the reader about the map. Additional map elements are used to add clarity and description to the map, but not obscure it.

Requirements:

- **Text** – all text in the map (aside from labels) should consist of only one font type, generally using a sans serif font
- **Legend** – include symbology for all features of interest in the map. Legend should have a light background, and a thin dark border
- **Scale bar** - should be included on all maps if relevant. Not necessary for inset maps. If working with a series of maps, use the same units of scale for all map documents
- **North arrow –** recommended, but only required if North is not at the top of the page
- **Data sources and dates –** should be listed for all the data used in the map
- **Disclaimer –** may include a disclaimer for use and accuracy of the data used in the map. If data is all from the same source, then a disclaimer and information box can be included in one place in the MP, rather than on each page (save space on park plates)

Guidelines:

- **Descriptive text –** If additional text is needed to describe the map, place it away from any important features in the map. Consider placing it in a text box with a light background and thin dark border
- **Inset map –** may be included if a reference area is needed to explain the map.

They should have a thin dark border and an extent rectangle to show the area of interest as it resides in the region

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Sample layout for a 8.5”x11” map

Corps Logo (ensure that it complies with USACE Graphics Regs)

Scale the map size to fit onto document page

Main Map with thin border

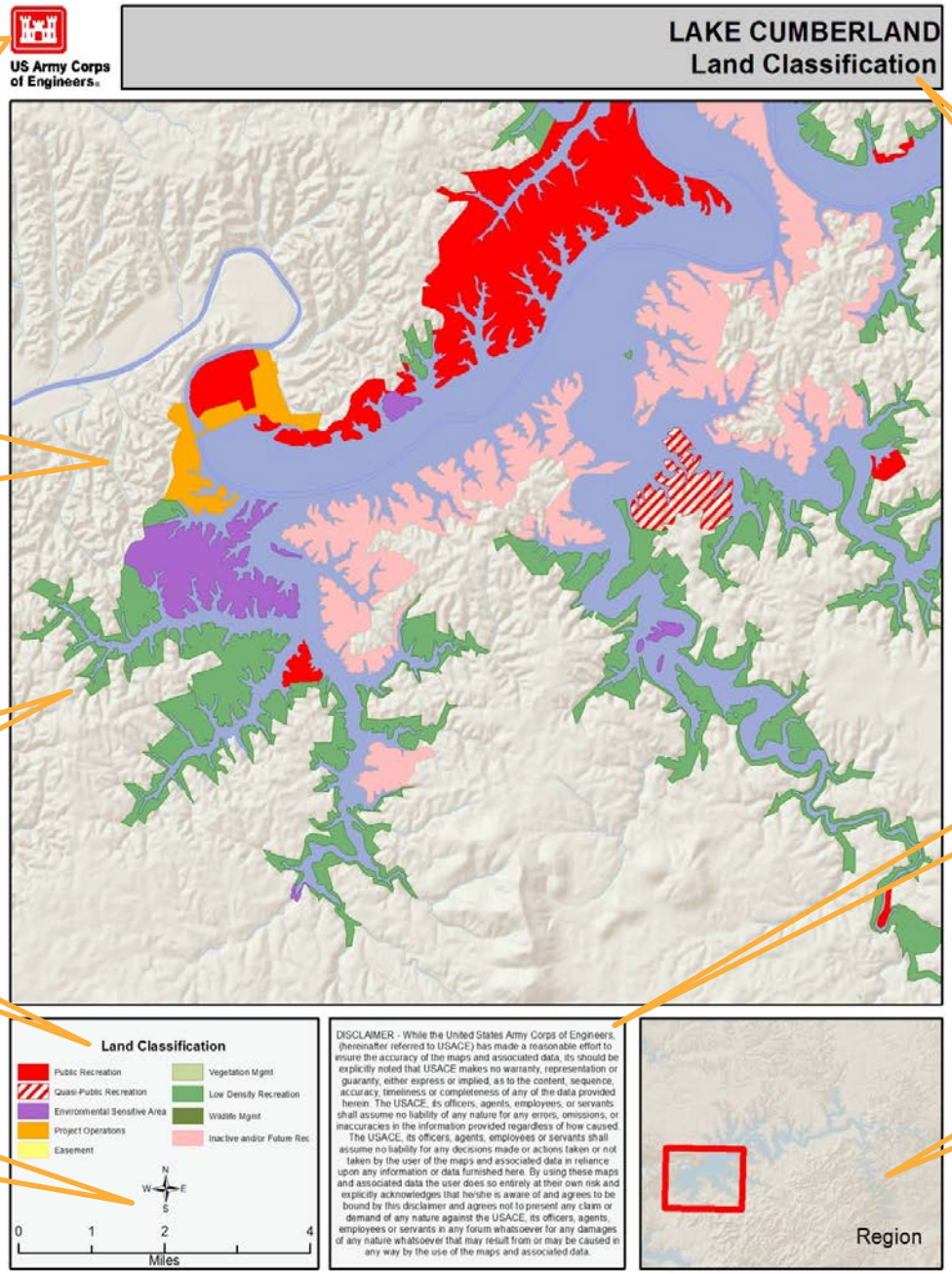
Legend

North Arrow and Scale Bar

Title and Subtitle

Information and Disclaimer Box

Region/Reference Map (with extent rectangle)



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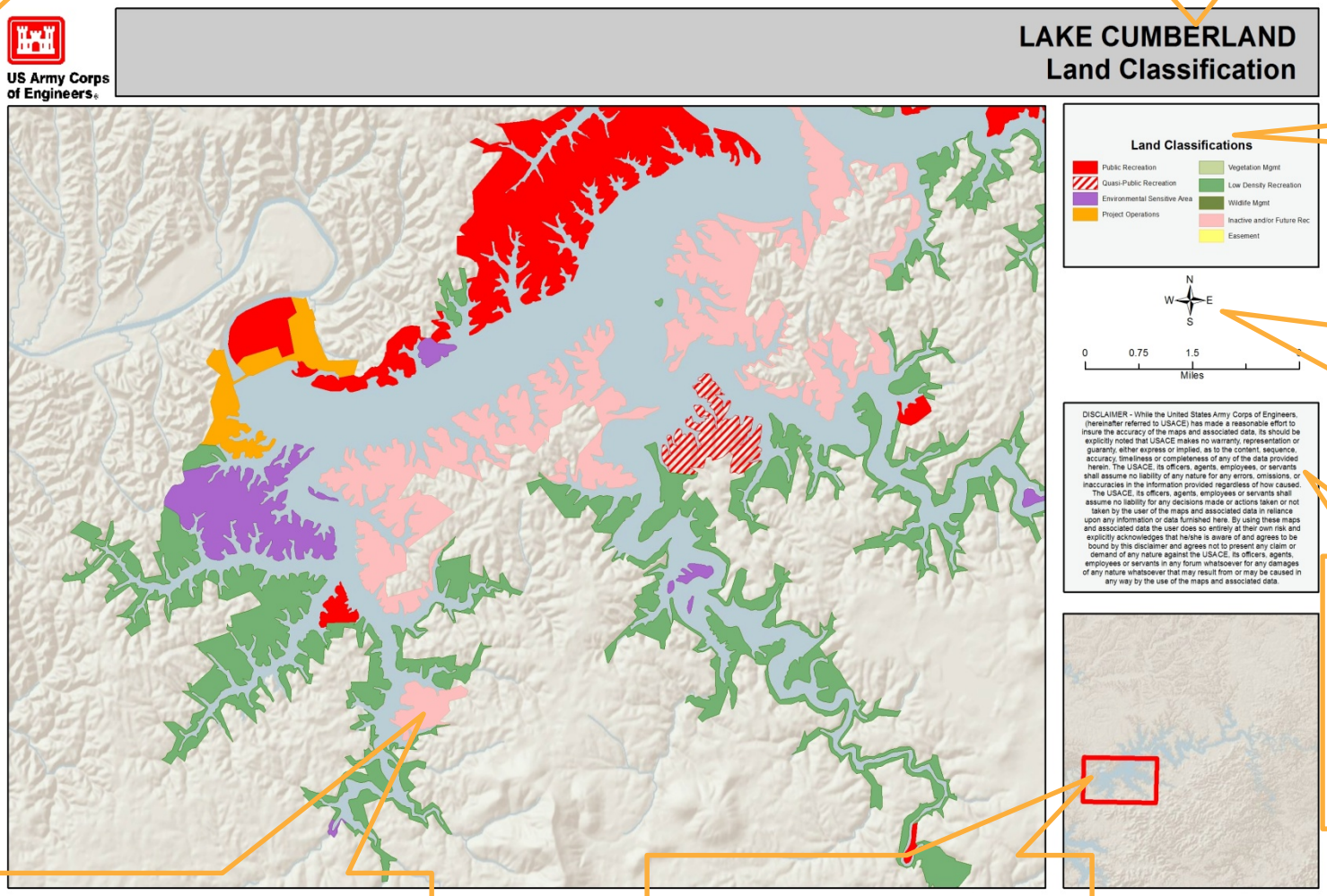
Sample layout for a 11”x17” map

Wide margin on binding edge

For 11”x17” maps, display title where it can be seen when folded



Legend

North Arrow and Scale Bar

Information and Disclaimer Box

Map content may fit better on an 11”x 17” page

Region/Reference Map (with extent rectangle)

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Guidelines for Symbols

Symbology Standards

In addition to standardizing map layouts for quick and easy interpretation, districts should develop a symbology standard to be used for all management documents. The use of consistent colors and symbols helps the reader by streamlining the information and making it easy to extract significance from map documents across the district.

Considerations:

- **Symbol size** – what size should it be so it is easily read?
- **Printed document** – will it be in color? Or black and white?

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Guidelines for Symbol Size

Recommended Minimum Symbol Sizes

Viewing Distance (feet)	Computer Screen (points)	Printed Maps (points)	Computer Screen (inches)	Printed Maps (inches)
1.5	6	4	0.08	0.06
2	8	6	0.10	0.08
3	11	8	0.16	0.12
5	19	14	0.26	0.19
10	38	28	0.52	0.38
20	75	55	1.05	0.77
30	113	83	1.57	1.15
50	188	138	2.62	1.92
100	377	276	5.24	3.84

Table from ESRI

Takes into consideration the distance at which your maps and documents will be viewed. Symbols should be recognizable to the viewer. While a 6pt size symbol will be legible in the Master Plan document, the same size elements will not be easily viewed on a poster-sized map for a public meeting. Make adjustments so maps are easily understood.

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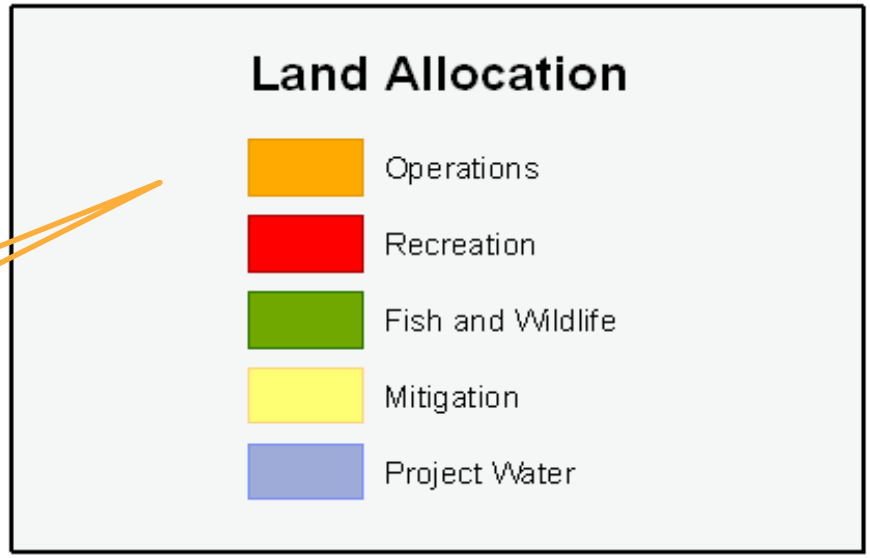
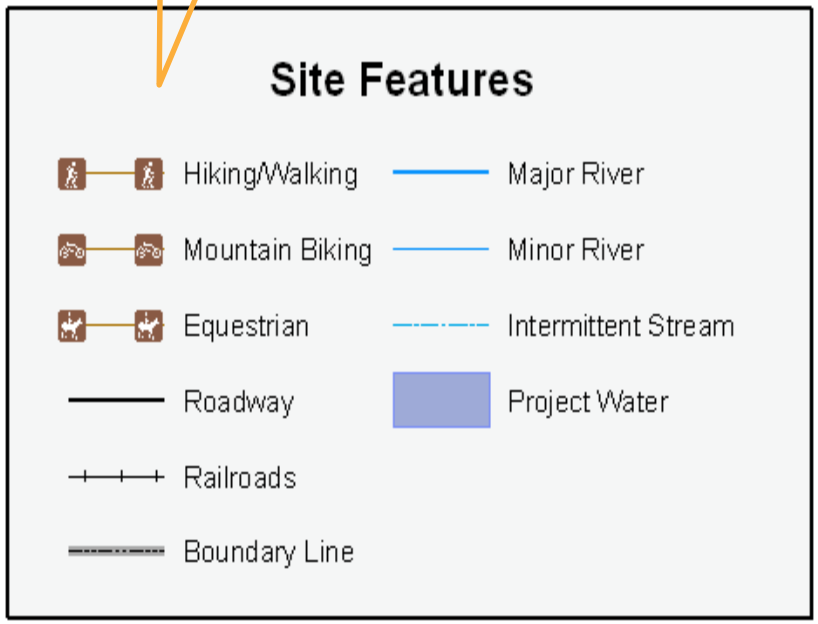
Examples of Symbology for Different Geometry Types

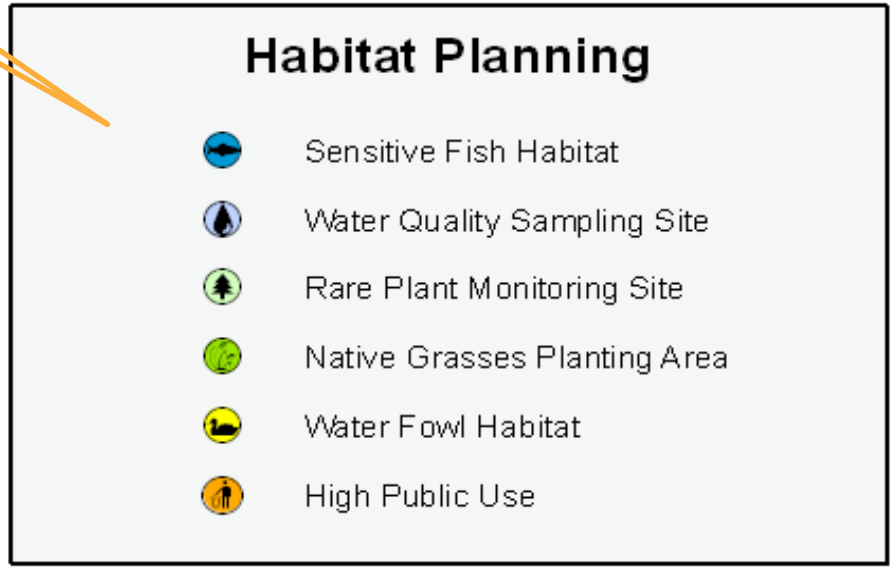
Areas (Polygons)



Lines



Points



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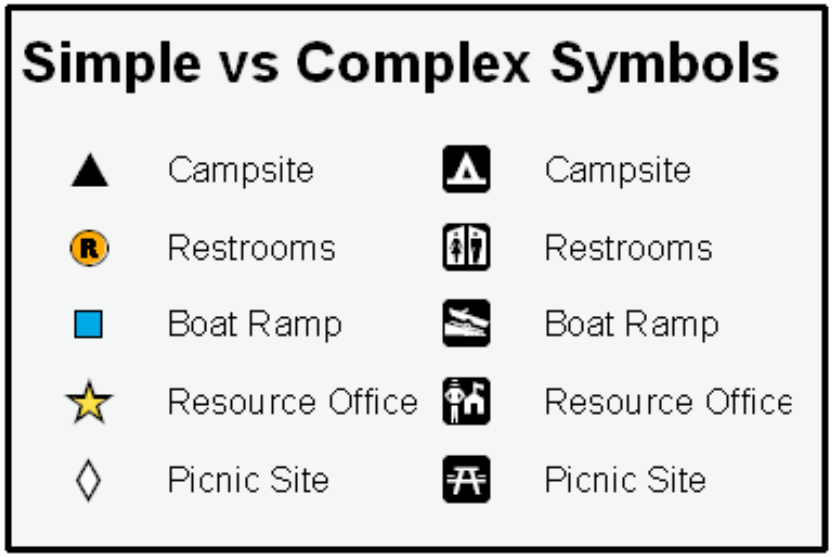
Guidelines for Level of Detail for Symbols



Notes on point symbols

•**Consider the scale:** a regional map may become too cluttered for detailed symbols and lend itself to simple ones; a site map may work well for complex symbols

•**Consider the audience:** a lake employee may understand simple symbols, while visitors to the project may need complex symbols

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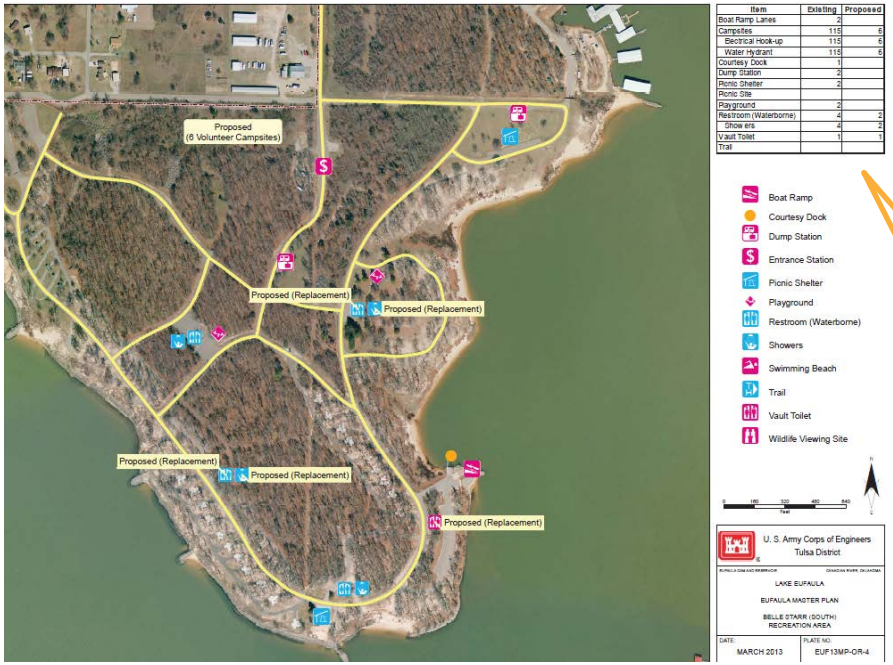
CONSIDER THE LEVEL OF DETAIL NEEDED FOR PARK PLATES

Choose between a detailed park plate vs. a “bubble diagram” style map. The time required to map every campsite may outweigh the benefits of a detailed map and the general bubble diagram may be preferable (Use OMBIL tables to supplement data)



Item	Existing	Proposed
Boat Ramp Lanes	2	
Campsites	115	6
Electrical Hook-up	115	6
Water Hydrant	115	6
Courtesy Dock	1	
Dump Station	2	
Picnic Shelter	2	
Picnic Site		
Playground	2	
Restroom (Waterborne)	4	2
Showers	4	2
Vault Toilet	1	1
Trail		

Generalized “bubble diagram” Park Plate with OMBIL Table Details

Detailed Park Plate

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EDIT AND REVIEW YOUR MAPS

Have two or three people carefully review your maps before publishing them for public viewing!

It could be very embarrassing (and costly to reprint!!) to have towns, lakes, or recreation areas misspelled!

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MAP CREATION TIME AND EXPERTISE

If a GIS professional isn't available in the district, other lower cost options may be viable

- **Student Aide, Intern, Summer Hire, or Co-op**
- **University Class**
  - Contract with University to map areas, practice GPS skills, or create a map book
  - Example – Michigan State with VERS modernization (would Scott Jackson have more input?)

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PROGRAMMATIC APPROACH TO MAPPING AND GEOSPATIAL DATA

Use of GIS **in all aspects of** the NRM program will continually develop the project's spatial dataset, ultimately saving time and financial resources during a Master Plan Revision or Supplement

- Obtain OMBIL data (soils, tree canopy, etc) from GIS
- Take GPS readings when marking boundary lines
- Share GIS information with state and local agencies
- Recycle VERS Modernization data for area maps
- Make sure any created spatial data is stored in the district's enterprise GIS database for future use

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ADDITIONAL MAPPING INFORMATION:

•FGDC.gov. Federal Geographic Data Committee

•Perry, C.H. and Nelson, M.D. (United States Department of Agriculture – Forest Service). 2006. Cartographic Standards to Improve Maps Produced by the Forest Inventory and Analysis Program

•Presidential Documents. 11 April 1994. EO 12906. Coordinating Geographic Data Acquisition and Access: The National Spatial Data Infrastructure

•SDSFIE.org. Spatial Data Standards for Facilities, Infrastructure, and Environment

•U.S. Army Corps of Engineers. 30 September 2005. EM 1110-1-2909, Engineering and Design – Geospatial Data and Systems

•U. S. Army Corps of Engineers. 30 September 2005. ER 1110-1-8156, Engineering and Design – Policies, Guidance, and Requirements for Geospatial Data and Systems

•United Nations. May 2006. OCHA Map Construction Guidelines – Elements of a Print Map V1

•Cartographic Standards Workgroup. 2006. King County GIS Cartographic Standards. King County, WA

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