

State of Montana GIS Accessibility Guide for Esri Apps

This document can be used as the primary guide to improve and remediate accessibility of Esri Online GIS applications.

Table of Contents

Table of Contents	1
Overview of Accessibility for Esri Web Apps	3
General notes about Esri App Builders.....	3
Providing Alternative Access to Data	3
Map Viewer.....	4
General Tips for Map Viewer	4
Symbology	4
Pop-ups	5
Dashboards.....	6
General Tips for Dashboards.....	6
Providing Alternative Access to Data with Dashboards.....	6
Dashboard Layouts.....	7
Accessibility for Dashboard Elements	8
Experience Builder	10
General Tips for Experience Builder	10
Providing Alternative Access to Data with Experience Builder.....	11
Experience Builder Layouts	11
Accessibility for Experience Builder Widgets.....	12
Story Maps	15
Color	15
Story format, style, and links.....	15
Plain language (required for U.S. Government organization)	15
Alt text for all media	15
Still media and maps.....	16

Audio and video	16
Instant Apps	17
Important Accessibility Concepts	18
Text and Typography	18
Headings.....	20
Links and Buttons	20
Images and Alt Text	20
Basemaps	21
Map Feature Styling Requirements	21
Techniques for Map Feature Styling	22
Magnification Requirements for GIS Applications.....	23
Ability for Users to Change Text Settings	24
Additional Resources	25

Overview of Accessibility for Esri Web Apps

General notes about Esri App Builders

- All web content is legally required to conform to all [WCAG 2.1 AA Success Criteria](#)
 - The WCAG criteria do not consider the complexities of interactive GIS apps
- All Esri ArcGIS Online app builders create a webpage composed of [HTML elements](#)
 - The resulting HTML code is what assistive technology, such as screen readers, interact with and what automated accessibility testing tools check.
- Although you will have limited control over the resulting HTML code of Esri Online apps, you can control what content is included in applications and how content is presented.
- The Esri application specific sections of this document outline steps that you can take to **do the best you can with the tools that are available**
- The [Important Accessibility Concepts Section](#) of this document provides additional information for concepts that affect all GIS applications.

Providing Alternative Access to Data

- All GIS applications should provide an accessible way for keyboard-only users and blind screen reader users to access important information shown in maps
- Many GIS apps contain important information that is only available by clicking on a map with a mouse. This is not accessible to keyboard users or screen reader users.
- Generally, alternative access to map data can be provided in data tables, downloadable csv files, and feature info elements.
- Specific methods to provide alternative access to map data are outlined in this document for Esri Dashboards and Experience Builder

Map Viewer

References for more information

- [Accessibility essentials for GIS and mapping](#)
- [Sorry, I Can't Read your Visualization](#) (not GIS specific, but good resource)

General Tips for Map Viewer

- Accessibility for maps elements must be configured in Map Viewer
- Accessibility for popup content elements must be configured in Map Viewer
 - Popup content can be displayed in Maps, Details or Feature Info Elements
- Try to choose a high contrast basemap as the default setting for maps
 - Users should be able to switch between multiple basemaps
- Ensuring proper contrast for map elements is complex, do the best you can
- Remove unnecessary layers and avoid clutter
 - Use scale dependencies to help differentiate between layers
- In ArcGIS Online Content, always give your map a clear title and short summary

Symbology

- Does your map use only color to portray important information?
 - Use informative symbols to differentiate point features
 - Use line styles to differentiate line features
 - Different line styles for roads, rivers, railways, etc
 - Use fill Patterns and line styles to differentiate polygon features
 - Be aware that excessive use of fill patterns may be distracting or difficult to decipher. It can be difficult to read a label under a pattern.
- Ensure Map colors are compatible with color deficiencies
 - Use colorblind-friendly color palettes when possible
 - Monochromatic palettes can be used as well
 - [Esri's color ramp generator](#)
- Ensure colors don't have extreme ranges
- Ensure Adjacent features have 3:1 color contrast ratio
 - This requirement is difficult to satisfy for complex maps, do the best you can
 - For more information, refer to [Map Feature Styling Requirements](#) and [Techniques for Map Feature Styling](#) Sections
 - Map Labels
- Map labels should follow the same accessibility standards as typography

- Minimum label size is 12px
- Ensure Labels are not at an extreme angle
- Text and background colors should have a 4.5:1 contrast level for labels
 - Use Halos for labels to ensure 4.5:1 text color to halo color contrast ratio. Halos operate as a consistent background for text.
- Reduce clutter by removing unnecessary labels and using scale-dependent visibility
- Allow space around labels and avoid overlapping labels
- Set labels to appropriate visibility ranges
 - Most important labels should be seen first
 - Street names should not be seen at county level etc.
- Refer to [Text and Typography](#) Section for more information
- **Note:** Map Labels are rendered as images for Esri Online Maps. Labels will not be accessible to screen readers, and are not html-based text content

Pop-ups

- Popup contents should have logical reading order. Only include data that is relevant to the final application
- Pop-up content should follow the same accessibility standards as typography
 - Make links unique and descriptive
 - Format lists as list elements
 - Text is aligned to the left
 - Minimum font size is 12px or .75rem
 - Ideal text font size is 16px or 1.0rem
 - Refer to [Text and Typography](#) Section for more information
 - Headings within popups should use proper tags in cascading order
 - Popup Titles use <h2> tags, headings within popups should start with <h3>
 - Headings should be concise, understandable and outline content
- Add Alternative text to images and media elements in popups
- **Custom HTML code can be inserted into popup content**
 - This is a powerful way to customize the presentation of important map data
 - Custom formatting and html code should conform to all [WCAG 2.1 AA success criteria](#)
- **Note:** Esri Map pop-up frames may not satisfy magnification requirements and may not be mobile-friendly. Map popups are also difficult to access by keyboard only controls, and do not have a logical tab order if opened from user interface list elements.

- **Alternatively**, popup content can be displayed in Dashboard details elements or Experience Builder feature info widgets, within an application layout that may work better for small screens and scaling requirements

Dashboards

References for more information

- [Improving the Accessibility of Your Dashboard](#)
- [ArcGIS Dashboards Accessibility Best Practices](#)
- [Colorado Example EEAAP for Dashboards](#) (lists Dashboards accessibility issues)

General Tips for Dashboards

- Dashboards are designed to be compatible with screen readers, such as VoiceOver and NVDA.
- Default dashboard themes meet minimum color contrast requirements
 - Double check for 4.5:1 contrast ratio for all text in final application
- Provide [feedback mechanism](#) for users to report accessibility issues
- If charts or graphs are used, ensure that the same data is provided in an accessible format, such as a table.
 - Consider providing a brief description describing important trends in data visualizations
 - Accessibility may improve for charts and graph elements over time
- **Note:** Dashboards are fairly good for accessibility and are being improved. However, layouts have accessibility limitations, some components are configured improperly.
- Dashboard does not have the skip to function like experience builder
- If anything with text does not have an option to change font size and type it is most likely styled in theme

Providing Alternative Access to Data with Dashboards

- **Data Download** can be enabled for users to download as a .csv for an accessible alternative
 - Many dashboard elements can be configured for data to be downloaded as a .csv file including filtered views or when map elements are selected.
- **Table Elements** can provide alternative access to important data
- **Details Elements** can provide alternative access to feature data from popups

- **Lists Elements** can provide alternative method to highlight and filter data in maps, tables and charts

Dashboard Layouts

- Make sure the header panel uses h1 heading tag for app Title
 - Only one h1 tag should be present in application
- Dashboard elements should include a title
 - Element titles will have h2 heading tags
- Use the accessible name property for dashboard elements with a short description to provide an accessible label that can be read by a screen reader
- Make sure all layout panels are visible by default, such as expandable side bars
- Tab order is set by the order of elements in a layout
 - Generally, the focus follows top to bottom and left to right flow
 - Starting at the header, sidebar, all elements and the dashboard reset button if present
 - To traverse the layout users can use “tab” key to highlight panels, then access elements within a panel by pressing the enter key, then tab to traverse interior elements
 - This focus order is unconventional, but is fairly intuitive?
- Create a separate mobile layout for small screens
- Minimize the number of columns in your layout
- **Note:** A Major limitation of dashboards is that layout panels can only use % units of screen height and width. This severely limits the creation of responsive layouts for small screens, font-only and browser page magnification requirements.

Stacking

- Multiple dashboard elements can be stacked in a panel which creates tabs that users can select from. These tabs are keyboard accessible, but lack ideal focus flow
- Can’t change the orientate of where tabs are on the layout, so it is only seen on the bottom
- Tabs have focus

Advanced Layout Tips

- Full screen dashboard apps can be embedded into a webpage with an iframe that has min-height property allowing it to switch to a vertically scrolling application on small screens and browsers with page magnification. However, front-end users cannot change text settings of content within an iframe.

Accessibility for Dashboard Elements

Rich Text Elements

- Rich Text Elements allow for custom styling and html code, which must follow all WCAG 2.1 AA website accessibility requirements
- Ensure custom headings fit within cascading heading structure for application
 - Title for Rich Text will be <h2>, start content headings at <h3> level

Tables

- Test table layout on small screens and on mobile devices
- Filter data to remove unnecessary information
- Increase table size to medium if space allows
- All information on tables should be fully visible
- Simple Tables provide accessible access to data
- Utilize field aliases and avoid the use of acronyms

Maps

- See **Map Viewer Section** for Improving Map Element accessibility
- For Map Elements, allow users to switch between different basemaps such as light, dark and high contrast.
- Avoid very slow and fast-moving animations, repetitive patterns and overly complex effects.
- When connected to a list when an item is selected, it will zoom into the map and then when deselected it will go back to initial point of view.
- Does not allow custom initial view
- Will only show popups if the feature is physically click not on the list
- Can add instructions for keyboard users
 - Limit the use of zoom and pan animations in the map.
- If popups are used, make sure popups only show necessary data.
 - See **Map Viewer: Pop-ups Section** for editing popup contents

List Elements

- List elements can provide an accessible way for users to select features and filter other elements
- Can skip the list to get to other elements instead of going through the full list
- Lists can provide keyboard only controls to select features on a map
- Lists can include a search field at the top, allowing quick navigation for long lists

- Provide users with instructions for how the list interacts with the application
 - example “select an item from this list to filter data or highlight map feature”
- **MT Editor Note:** Dashboard Lists are implemented poorly as divs with table aria tags with a single column, rather than as a semantic html list element. Lists are not announced by screen readers as a list by default.
 - You should provide instructions for blind users, identifying the list as a List that can be used to select and filter data.
- When elements are selected in the list, a small selection icon is shown on the left, which may be hard to see

Serial and Pie chart

- Increase text size for the axes titles and levels
- Avoid using only color to show data
- Choose a theme first and then create the chart
- Use series or slice instead of a legend
- Charts may not be fully accessible, provide alternative way to access data
- When you have too many fields it will hide every other labels
- If you set a minimum view, it will only show that amount

Embedded Content

- Check that any embedded content meets accessibility standards
- Headings within embedded content should align with heading structure of Dashboard Application
- Embedded content should be evaluated in the source URL if using an automated accessibility checker
- Front-end users can not change text settings of content within an iframe.

Experience Builder

References for more information

- [ArcGIS Experience Builder Accessibility](#)
- [Colorado Experience Builder Accessibility Resources](#)

General Tips for Experience Builder

- It is recommended that you use full screen and scrolling pages to build accessible apps
- Navigation focus order follows the order in which widgets were added to the canvas. Rearranging the order of elements in the element outline will change focus order.
- Things to help with reflow order
 - Placing elements in column widgets can force resizing widgets for scaling. It can also create padding for elements
- For size and position for some elements you can use stretch and auto
 - Stretch – Automatically set the size based on the size of the widget's container
 - Auto – Automatically set the size based on the widget's content. Use this mode for widgets that display dynamic content
- The text's for some text items size and positions
 - Width – stretch
 - Sets the size to the length of the container
 - Height – auto
 - Stays the same size as the text rem
 - This means the text will resize automatically when the window size changes since it is rem units and rem units automatically resize as the window changes
- If anything with text does not have an option to change font size and type it is most likely styled in theme
- Alternatively, you can click the A11Y button at the lower right corner of the builder and turn on Auto-calculate element tab orders in fixed layout. It is recommended to click this before you start adding widgets.
 - If widgets are already made you can list them as pending and then re-add them in a logical order for keyboard users.
- Enable accessibility settings for each widget
 - Accessible label – provides label for the widget to get read by screen readers

- Enable in Skip to – tab order shortcut that allows users to jump directly to focusing on this widget in the keyboard tab order
 - This should only be used for a few important sections of app interface

Providing Alternative Access to Data with Experience Builder

- **Tables** can provide alternative access to important data
- **Lists** can provide alternative method to highlight and filter data in maps and tables
 - Lists can also be configured to display important feature data
- **Feature Info widgets** can provide alternative access to feature data from popups
- **Nearby widgets** can be used to configure a way for sighted keyboard-only users to query features directly on a map
- **Data Download** can be enabled for users to download a .csv for an accessible alternative

Experience Builder Layouts

- Layouts should be responsive to different screen sizes and orientations
 - Refine separate layouts for Desktop, Tablet and Phone
- Important user interface panels should be visible by default
 - Side Bars should start out as expanded

Ersi Recommended templates

- Billboard, Dart, Foldable, Jewelry box, Launchpad, Plateau, Pocket, Tab

Default themes with optimized color contrast

- Default, Dark, Ink, Violet, Vivid, Organization shared

Advanced Layout Tips

- User interface panels should dynamically adapt to content
- Avoid using % units to size layout containers and panels
 - If possible, it is best to size layout contents with rem units
 - for now use pixels instead, (in multiplies of 8 work best for screens)
- Use [Column](#) and [Flow Row](#) Components as dynamic containers
 - Flexbox-based containers expand based on the size of contents
 - Stretch can be used for width and height of elements to fill remaining space in columns and flow rows

- A vertical scroll bar should appear for columns that can not fit all content
- Layouts should scale without hidden or overlapping content with browser magnification and font-only zoom
- When possible, use Auto for height of components within column Elements
 - Components should scale with font-only zoom
- Full screen experience builder apps can be embedded into a webpage with an iframe that has min-height property allowing it to switch to a vertically scrolling application on small screens and browsers with page magnification. However, front-end users can not change text settings of content within an iframe.

Accessibility for Experience Builder Widgets

Listed widgets will have extra accessibility steps

- Maps
 - See **Map Viewer Section** for Improving Map Element accessibility
 - For Map Elements, allow users to switch between different basemaps such as light, dark and high contrast.
 - When connected to a list when an item is selected, it will zoom into the map and then when deselected will go back to initial view
 - Can dock popup but it doesn't have much flexibility
 - Can not select map elements with a keyboard
 - WAVE tool can't see map
- Feature Info
 - See **Map Viewer: Pop-ups Section** for Improving Map Element accessibility
- Chart
 - Scrollable to zoom into different elements of the chart can use a keyboard as well
 - Can download data for alternative access
 - Cannot select items with a keyboard to view details
 - WAVE tool can't see chart
 - If text label is too long you are unable to view it
- Column
 - Add padding to display the focus ring for widgets inside a column
- Coordinates

- Obtaining the coordinates from the map is not supported by the keyboard
- Directions
 - Reordering stops and adding stops by clicking the map are not supported by the keyboard
- Draw
 - Drawing on the map is not supported by keyboard
- Image
 - You can manually add alt text to images
- List
 - You can use the Esc key to exit a dynamic list
 - Can use rem units which is recommended units for the reflow requirements
 - Can assign heading tags
 - Accessible labels which describe the widget for screen readers
 - Enable in Skip to – table order shortcut that allows users to jump directly to focusing on this widget in the keyboard tab order
 - No option to add a header
 - Workaround: You can place a text element in the layout for instructions
 - Can not have a background color, it will not show the focus order



- **You have to go through all items on the list to move to the next element**
- Map layers
 - Use left and right arrow keys to expand and collapse group layers
 - You can use the space and enter key to reorder layers with the reorder drop-down menu options
 - After you perform an action, keyboard focus may not return to the options button automatically
- Button
 - Avoid icon-only buttons without labels
 - Shows focus
 - The order the buttons are placed is how the focus order sees them
 - Very difficult to create a logical focus order
- Print

- Only Classic mode is supported
- Swipe
 - Advance templates are not supported by the keyboard
- Table
 - Selecting table records is not supported by the keyboard
 - Can download data for alternative access
 - Can use keyboard to navigation but it is clunky
 - Will show focus but you have to tab through each element of the table
- Text
 - You can define heading levels in the widget setting under text format
 - Can use rem units which are the recommended units for the reflow requirements
- Timeline
 - Moving the slider is not supported by the keyboard
- View navigation
 - Quick styles slider, arrow 1 and arrow 3 are not supported with screen readers
 - Can use with keyboard but has no focus order

Story Maps

References for more information

- [ArcGIS StoryMaps Accessibility Checklist](#)

Color

- Can create a custom theme in theme builder which allows for color on the spectrum for the background, text and other design elements
- StoryMaps has a built-in contrast checker

Story format, style, and links

- Consistent layout using short headings and subheadings (create screen reader navigation structure)
- Font styles are easy to read, legibility of serif vs sans serif (subjective)
- Theme is accessible, has sufficient color contrast
- Time awareness, aim to keep reading time under ten minutes
- Links have a short, meaningful descriptions, website is named in hyperlink or within the sentence (do not use “click here” etc.)
- Reading time is under 10 minutes

Plain language (required for U.S. Government organization)

- Uses simple terms, consult PlainLanguage.gov for the complete [Plain language guidelines](#)
- Language is accessible, word choices or idiomatic expressions may affect understanding and translations
- Reading level is accessible for audience, uses short sentences and simple words unless adding definitions
- Meets organizational inclusive language guidelines

Alt text for all media

- “Object” + “Action” + “Context” structure, may be a short phrase, no punctuation
- Uses 140 characters or fewer for simple media, complex media balances useful context and brevity
- Describes the media in the context it appears, doesn’t repeat caption, running text, or add conclusions

- Limited embedded text, all text embedded in graphics included in alt text regardless of length

Still media and maps

- Image gallery blocks include contextual alt text describing all content within the gallery
- Charts, graphs and tables including title caption, headers axis labels, no merged, split, or blank cells
- Alt text describes maps purposes if not already covered in running copy
- Simple map alt text uses known reference points example from [Penn State University's New England map](#)
- Consistent all text formatting for complex maps [ArcGIS Blog example](#)
- Charts and graphs will use high –contrast colors
- Charts and graphs have alt text

Audio and video

- Has alt text describing ambient sounds or has text transcript for spoken words
- Includes video captions or VTT transcript in accessibility settings
- Closed captions enabled on YouTube videos

Instant Apps

Important Note: To further customize instant apps, you need to turn off express mode

References for more information

- [Advanced Workflows for Building Accessible Instant Apps](#)
- [Calcite Design System Foundations](#)
- Add alt text to images using HTML in rich text editors
- Change keyboard focus indicator color with custom CSS
- Set custom theme colors with a built-in color contrast checker to ensure legible text for users with visual impairments
- Include map descriptions to provide the option to add a text description of your map or scene that will be read by the screen readers
- Enabling the shortcuts menu
 - App adds a tool with a list of keyboard shortcuts available for interacting with the map
- Contrast verification in theme editor
 - Theme editor allows app authors to choose from a set of preset theme colors or create their own
 - Contrast ratio of the text and background color appears next to the theme colors to confirm

Important Accessibility Concepts

- There are many important accessibility concepts that apply to all web content, whether it is an interactive GIS application, webpage or document.
- As there are few in-depth resources for how accessibility concepts apply to GIS applications, the following sections provide additional information.
- When learning more about GIS Accessibility, it is important to understand how different accessibility concepts relate to the [WCAG 2.1 AA Success Criteria](#), which are the legal standards agencies must meet for ADA / Section 508 Compliance

Additional Resources for GIS Accessibility Concepts

- [Esri Accessibility Documentation Website](#)
 - This is a good starting point to learning more about accessibility concepts
- [Colorado GIS Accessibility Resources](#)
 - Overview of general concepts for GIS Accessibility
- [Minnesota Accessibility Guide for Interactive Maps](#)
 - More indepth information for accessibility concepts
- [Audiom / XR Navigation Blog](#)
 - In-depth research and analysis of GIS accessibility, practical examples of alternatives

Text and Typography

- Accessibility concepts for typography apply to all text in map labels, popups, user interface components, web page content and pdf documents
- Editing text properties is an important tool to improve readability of information
 - With Esri App Builders, **you will have limited control to change some text properties** such as line height, character spacing and size with rem units
 - You will have full control of html text properties when editing Rich Text Elements or popup content that can be displayed in maps, Dashboard Details and Experience Builder Feature Info elements

Text Contrast:

- **WCAG SC 1.4.3 Contrast** requires high contrast for text color and backgrounds
- Small text should meet 4.5:1 foreground to background ratio
 - For map labels, halos can be used as a consistent background color
 - Otherwise, label text would need to be tested for all underlying content in all cases

- Large text can have 3:1 foreground to background ratio
 - Large text is generally defined as 18px bold or larger or 24px or larger
 - The difference between large and small text depends on what font is used

Text Styling:

- **WCAG SC 1.3.1 Info and Relationships** requires that text is styled appropriately
- Underlining should only be used for hyperlinks
 - If text is not a link, do not make text look like a link
- Bold should only be used to convey important information
 - `<strong>` tag is narrated to screen readers, `<b>` tag is not
- Lists of information should be formatted as lists using HTML list tags
 - Use numbered, Ordered Lists `<ol>` if the order of items is important
 - Use Unordered Lists `<ul>` if the order of items is not important
 - Nested lists can be used to create a sub list for a particular list item
 - The tags for the nested list should be contained in the parent `<li></li>`

Typography Best Practices

- The following points are not specific WCAG requirements, but are general best practices for accessibility
- Use left justification for blocks of text
- Use simple, commonly used fonts such as Arial, Calibri, Helvetica, Tahoma, Verdana, Times New Roman, Georgia, Book Antiqua and Palatino
- Avoid ALL CAPS
- Aim for 16px (1.0rem) as a base font size
 - Consider 12px (.75rem) as minimum font size for GIS applications

Advanced Text Requirements

- The following points are defined under WCAG 2.2 AAA Success Criteria
 - AAA is not part of the current ADA Title II or Section 508 requirements
- Reading Level
- Define abbreviations and acronyms, avoid industry specific jargon
- Do not use Full text justification
- Ensure users can apply Font-only text scaling up to 200%
 - This can be tested in Firefox with the Zoom Text Only setting enabled

Headings

- Headings in web pages and web applications provide a way for screen reader users to quickly understand and navigate content
- The heading levels of the final web page should be in a cascading order, starting with a single <h1> tag at the very top of the web page or application
- If the web application contains multiple pages, a unique <h1> tag should be used as the title of each page
- Proper heading levels will depend on the final context of the web application, and may be different for full screen apps, story maps, and embedded apps

Links and Buttons

- **Links** in any part of an application should be unique and descriptive, describing the specific resource they point to
 - Links navigate to a new web page, or jump to a location on the web app
- **Buttons** should have text that describes their function in plain text, or an accessible label that is announced to screen reader users
 - Buttons perform an action or a function on the web app
 - Buttons should be styled differently than links

Images and Alt Text

- Any image, icon or graphic should have a text alternative if it serves a purpose
 - Alt text should be provided for images that describes the purpose of the image in the surrounding context
- Alt text should include any text that is contained within an image
- Decorative images, or images with redundant information, do not need alt text
- Graphs and charts should have alt text that describe important trends
 - If possible, include data for graphs and charts in text or a table
- Use the [Alt Text Decision Tree](#) to determine if alt text is needed for an image
- **Static images of maps** should have alt text describing important relationships and information shown in the map
- **Interactive maps** can have alt text that identifies the map as an interactive feature and directs blind users to an alternative interface where they can access map data

Basemaps

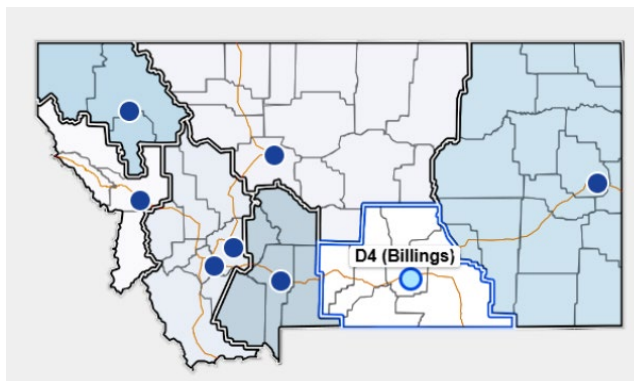
- Applications should allow users to choose between basemaps, including
 - Light enhanced contrast basemap
 - Dark enhanced contrast basemap
 - High contrast basemap
- Make sure Important labels are clearly visible at appropriate scale levels
 - Cities
 - Important landmarks
 - Major roads
 - Emergency Services
- Use the Esri Vector Tile Style Editor to modify basemap colors, label typography, feature visibility and remove unnecessary content
- Consider how features overlayed on top of basemaps will affect contrast and clutter

Map Feature Styling Requirements

- WCAG **SC 1.4.1 Use of Color** and **SC 1.4.11 Non-text Contrast** apply to how map features are presented to users
 - Color should not be used as the only means of conveying information or distinguishing a visual element
 - Parts of graphics required to understand the content should have a contrast ratio of at least 3:1 against adjacent colors
- It should be assumed that these requirements apply to the final composition of map layers as displayed on a user's screen
 - Overlapping elements and blending modes will affect contrast and coloring of underlying elements
 - Partially transparent or opaque layers within maps may reduce the contrast of basemaps
- Using color-blind friendly palates is not a strict requirement, but is an important consideration
 - As long as color is not the only means to convey information, colors that are not color-blind friendly may be used

Techniques for Map Feature Styling

- Use a combination of color with different line, point and shape styles
- You can use commonly understood Icons to differentiate point features
- Map Viewer Layer Effects may be used to highlight and increase contrast of features
- Blending modes such as multiply, screen and overlay can be used to preserve contrast, but work differently depending on underlying elements
- Oreo Borders may be used for polygons to differentiate features
 - Overlapping oreo borders should be tested
- [Advanced feature styles for webmaps can be imported from ArcGIS Pro](#)



Example of map with Oreo Borders (ensures 3:1 contrast between adjacent polygons)



Example of basemap with multiple line and polygon styles with 3:1 contrast ratio and color-blind friendly pallet

Magnification Requirements for GIS Applications

- Applications should satisfy both **WCAG SC 1.4.4 Resize Text** and **1.4.10 Reflow**
- Users should be able to use 200% full-page browser magnification to double the size of text and increase the size of layout elements within a 1280px wide window
- The Full WCAG SC 1.4.10 requirements specify that applications should also scale up to 400% with full-page browser magnification within a 1280px wide window
 - This is the equivalent of a 320px wide window, a standard minimum viewport width for mobile devices
 - 200% full page magnification may be a more practical goal for GIS applications
- With page magnification, application pages are allowed to scroll vertically
 - Elements such as large tables can scroll side to side if they are within a separate, scrollable container
- Full page applications, which is the default for some Esri Apps, are likely to severely fail browser magnification requirements
- Full screen applications can be embedded into a webpage with an iframe that has min-height property allowing it to switch to a vertically scrolling application on small screens and browsers with page magnification.
 - However, front-end users can not change text settings of content within an iframe, see the following point for Ability for Users to Change Text Settings.

Ability for Users to Change Text Settings

- **WCAG SC 1.4.12 Text Spacing** requires that users have the option to change text to the following settings:
 - Line height (line spacing) to at least 1.5 times the font size
 - Spacing following paragraphs to at least 2 times the font size
 - Letter spacing (tracking) to at least 0.12 times the font size
 - Word spacing to at least 0.16 times the font size
- These text settings are not required by default, but rather that users can override styling to apply these settings
 - Avoid changing text spacing properties in html <style> or style="" tags
 - Avoid use of !important for text spacing properties in css
- Plugins such as the 1.4.12 Text Spacing [accessibility bookmarklet](#) can be used to test this capability
- Embedded applications may not pass this test, as users generally can not override css settings of content within iframes
- Agencies may need to choose between using iframes to allow for page magnification, or default Esri hosted full screen apps that allow for User defined text spacing.

Additional Resources

- Compiled Esri App Resources from Accessibility Working Group: [Esri Resources](#)
- Esri Accessibility: [Accessibility Resources | Accessibility Standards & Guidelines](#)
- [Esri Accessibility Documentation Website](#)
- [Colorado GIS Accessibility Resources](#)
- [Colorado GIS Accessibility Checklist](#)
- [Minnesota GIS Accessibility Resources](#)
- [Minnesota Accessible Map Training](#)
- [Minnesota Accessibility Guide for Interactive Maps](#)
- [NSGIC GIS Accessibility Resources](#)
- [University of Virginia GIS Accessibility Resources](#)
- [Audiom / XR Navigation Blog](#)
- [Systemically Evaluating Digital Map Tools Based on the WCAG](#)