GIS AND INFRASTRUCTURE- THE BIG AND THE SMALL OF IT

Why moving ahead with infrastructure improvements should include improving and implementing GIS

100 YEARS

LEADING THROUGH
the next 100 years

ASCE 2021 Report Card for US Infrastructure

- America's current infrastructure grade is a C-, Ohio's C-
- Water C- , Stormwater D, Wastewater D+, Levees D, Inland Waterways D+
- **A water main breaks every 2 minutes** – losing ~6 billion gallons of water a year
- Continued expansion of suburbs is expanding the pressure on existing Stormwater systems
- Large majority of sanitary pipelines and treatment plants are reaching the end of their lifespan

State Infrastructure Rankings | ASCE's 2021 Infrastructure Report Card

Challenges of Existing Infrastructure

- The majority of US cities, towns, and municipalities don't have a complete picture understanding of the what, when, where
- Most infrastructure installation in the US preceded the digital world, operating on paper as-builts and maps
    - Many small cities and towns still operate with paper
    - Some converted their data to digital
    - Others have wandered into GIS

But the good news is there are many communities, counties in particular, that have strong GIS systems!

Challenges of Existing Infrastructure

- *Not* knowing the what, where, when of infrastructure causes issues for both scheduled and forced maintenance due to failure
  - What is the size of the water main we are tying into?
  - Where does that storm sewer drain run too?
  - When was that valve last replaced?
  - What other assets are going to be affected in a replacement?
  - How many water lines tie into that section?
  - Is there cross contamination of waste water and storm water?
  - Where is the shut-off valve?
- Knowing the what, where, when, is only half the battle
- Not KNOWING can cause a delay in response and millions of dollars in additional labor, materials, and damage to property

Next Steps?

- The other half of the battle is long- and short-term planning
- Delays in materials and labor shortages are increasing the need for more planning and prioritizing
- How do municipalities prioritize projects when they don't have all of the information?
  - **Lead piping is a prime example of not knowing**; to this day they are still discovering areas where lead piping is in a water system
  - Municipalities have had a lot of funding quickly change course due to new discoveries of lead piping
- Many of todays infrastructure projects are still being completed without having a single-source-location for information

Next Steps?

How does a municipality track all of the new information created after a replacement?

Example: a city just installed a new water main

- Pipe material
- Pipe size
- Location
- Valve type and location
- Connection type
- Dead ends
- Hydrant tie ins
- As-Built Drawings

Why throw that new information back into a drawer or on a local computer? What if the new pipe material or valve is found to be defective 5/10 years into the future?

Geographical Information Systems (GIS)

GIS Definition

Creating, manipulating, organizing, visualizing, analyzing and storing **information** for geographically located data

GIS has been used for big data covering large areas for decades. **Its time to start pushing GIS solutions to the smaller things and managing GIS infrastructure for our municipalities.**

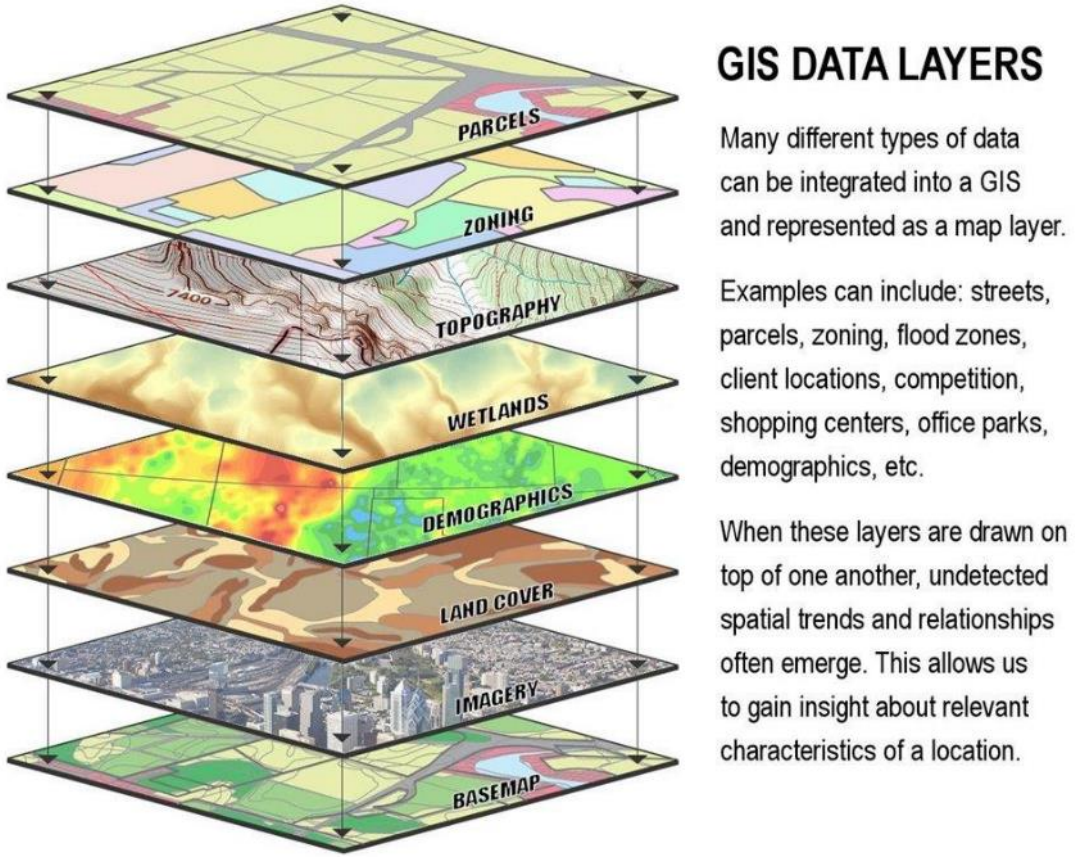


Image courtesy of Andrei Vorobev / GIS and Environmental Monitoring

Important to Note – GIS

GIS is and always has been *information-first software*

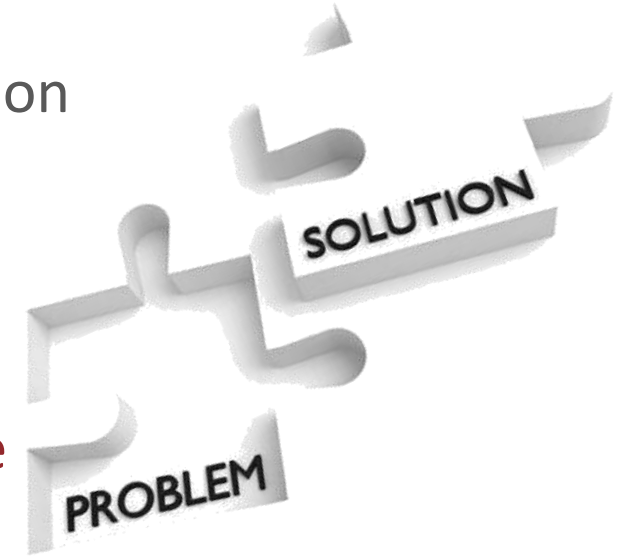
- Meant to provide information of an asset
- Pole = pole type, material it is made of, what is attached, ownership, height, etc.
- XYZ location can be relative or precise – not always defined

Historically, GIS has not been Geographical **Location** Services

- Accuracy of GIS data is wide-ranging because not all GIS data needed precise location
- GIS started as blobs of data, grouping information together, not single points
- For a long time, Arc software had a lower precision than many CAD software platforms, so conversion was not 1-1
- The focus of GIS was on the information, not the precise location

How is GIS Changing?

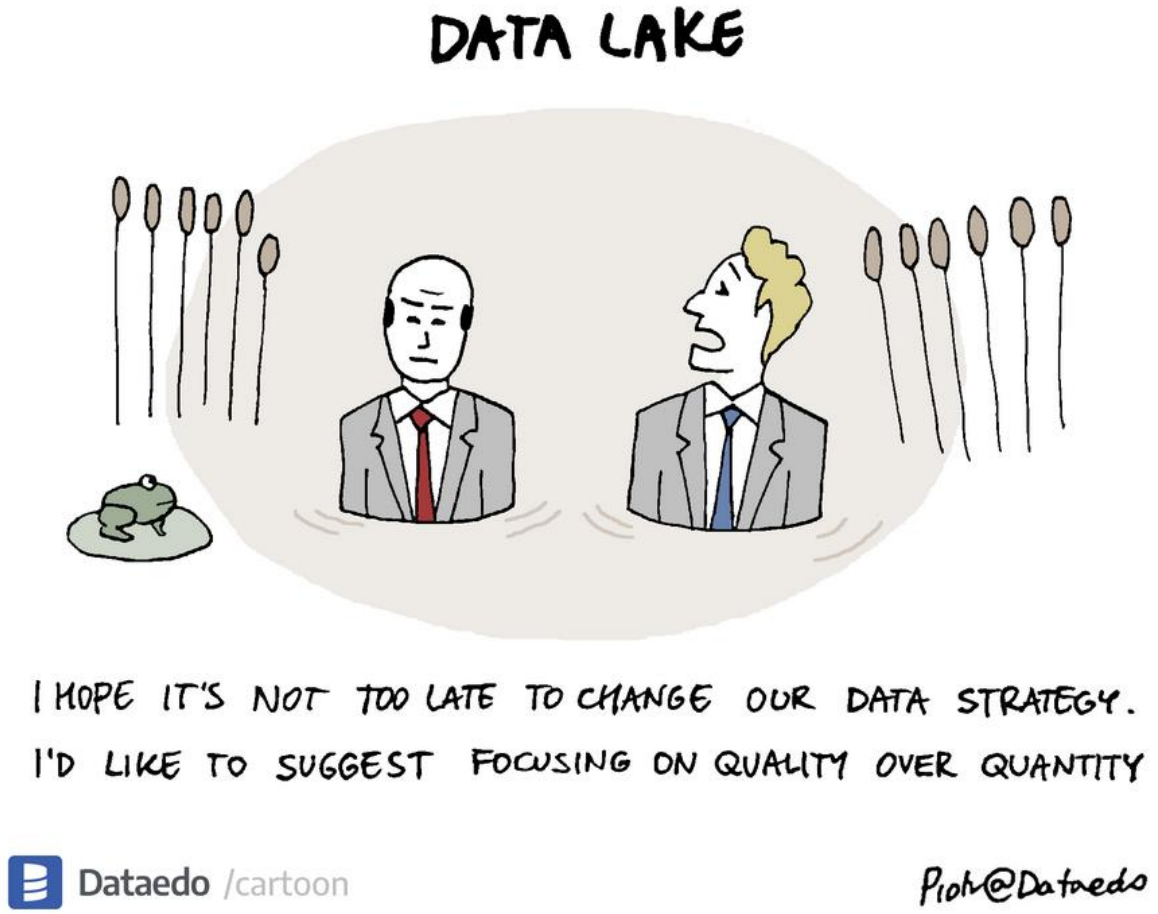
- ESRI was leaving out a large group of clients
- ESRI improved Arc's abilities to handle more precise information
- ESRI developed standard layering schemas for clients such as water/wastewater
- GIS has the ability to store historical data/info
- GIS has become more affordable and more easily supportable remotely
- GIS has/can become a tool for municipalities to help manage their assets



GIS – Changing Our Thinking

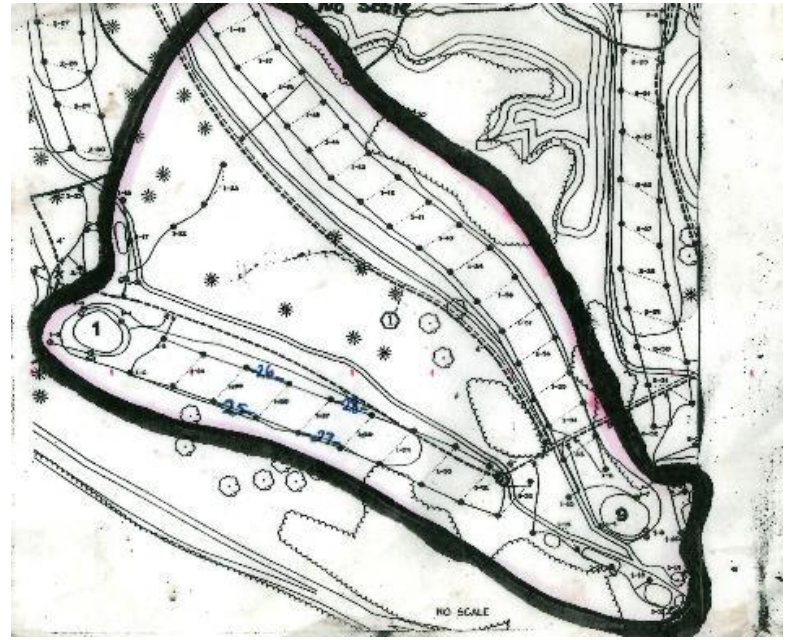
We need to remember that **GIS is just a tool**

- Good base data = Good GIS data
- Bad base data = Bad GIS data



The Big and the Small of it!

- The Small – golf courses run like a small municipality
- Original paper maps of sprinkler system installation
- When a leak occurred, they had to find the buried valves
- Converted to GIS, creating a digital map with valve and sprinkler locations
- Saves them time searching for valves, reduces the loss of natural resources (water)
- Gives digital intelligence to an otherwise simple system

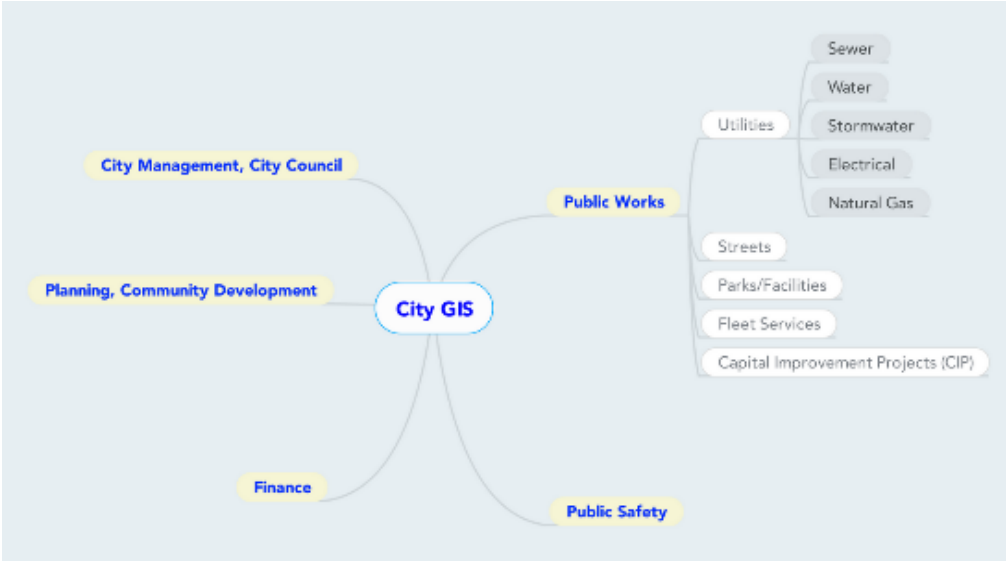


The Big and the Small of it!

- The Big – we are collecting a ton of new field data, mapping, imagery, topo, existing as-builts, etc.
- A lot of the data we create gets wrapped up in a final CAD
- That data gets chopped up, dissected for final engineering design
- **BUT** There is a lot of value in **both** the original data and the final engineering data
- All of it can be placed into GIS, allowing the municipality to have on-hand information and intelligence

Suggest Guidelines for Establishing GIS

- GIS should be done in small steps and over time
- Keep the process simple
- Educate key stakeholders and clearly define project scope
- Prioritize needs and wants – establish a roadmap
- Understand the existing information (if available)
  - Investigative stage
  - Understand the quality existing data
  - Remember bad data **in** = bad GIS **out**



Suggest Guidelines for Establishing GIS

- Do not over complicate the features and attribution in the GIS system
  - Easy for us to throw everything into GIS – we all love data!
  - Can lead to GIS burnout because the municipality has to maintain that information
  - Lets not help create more work
- Understand how the municipality functions
  - Do they have the capacity to support GIS? Do they need training?
- Be the consultant!

Future of GIS and Infrastructure

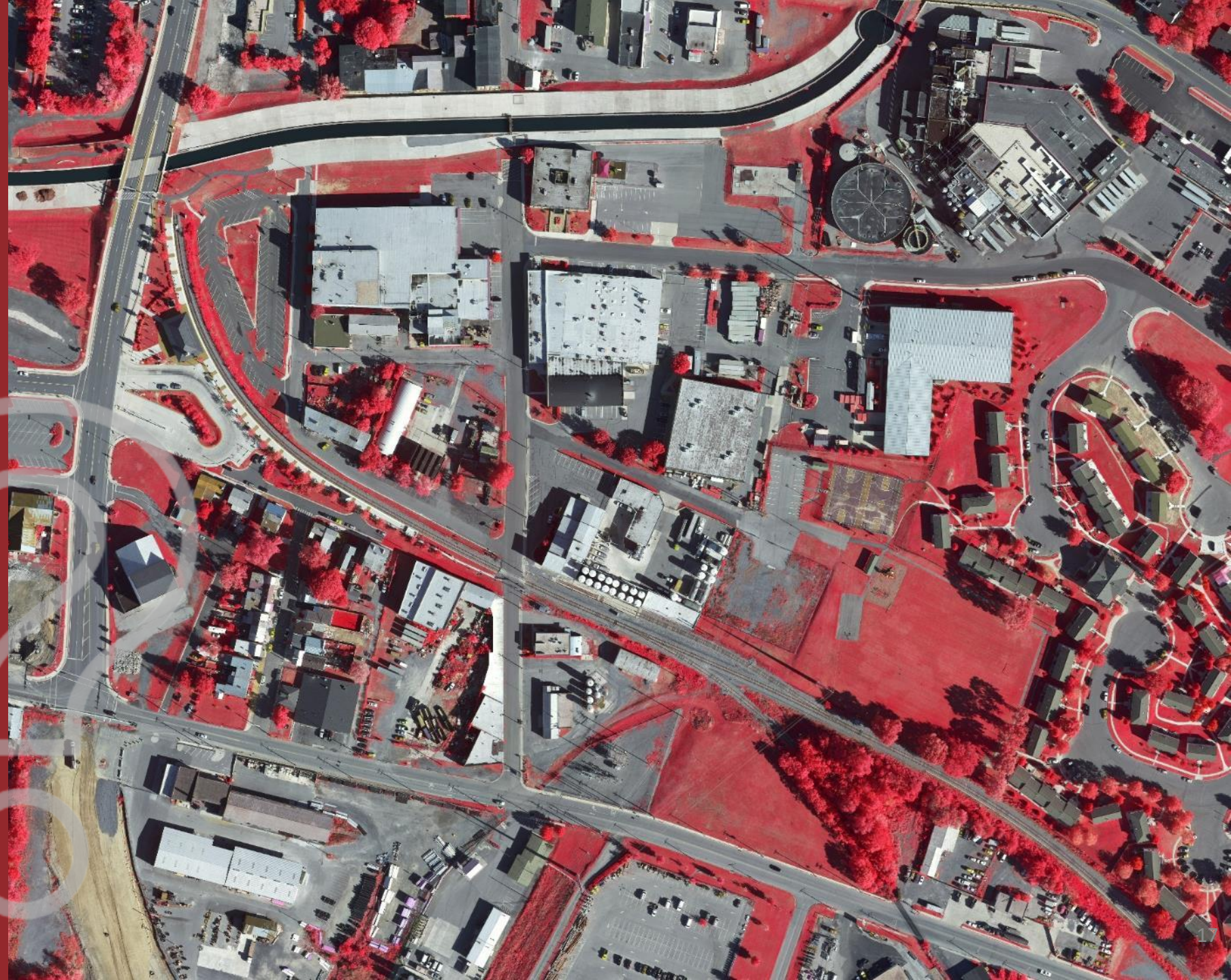
- Most people are more comfortable using a phone, tablet, or laptop
- Having instant remote access to information in the field at any time to support infrastructure is the next logical step
- Active information from various infrastructure systems can be brought into or linked to GIS
- Gives the municipalities the ability to respond to manmade and natural disasters
- Overall – should reduce labor/maintenance cost and help better plan for their future!

THANK YOU

ANY QUESTIONS?

100 YEARS

LEADING THROUGH
the next 100 years



Sources

- Slide 23, GIS definition, www.esri.com, picture www.falmouthma.gov