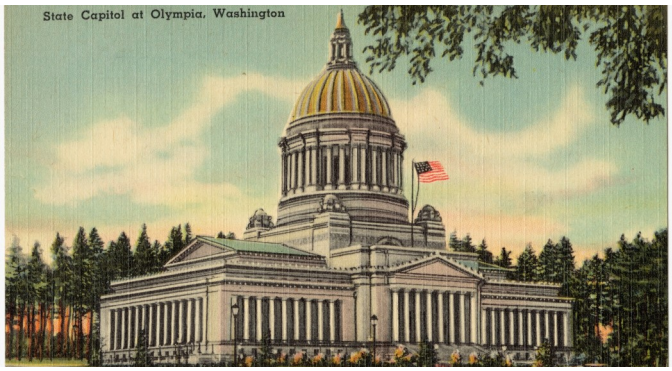


News From and For the Washington GIS Community

WAURISA: The Washington State Chapter of URISA
The Association for GIS Professionals
WWW.WAURISA.ORG

Issue 54
Late Fall 2020

THE SUMMIT

President's Column

Stephen Beimborn, City of Seattle

As a toddler, one of my sons had an expression that never ceased to amuse me. When asked to do some task, he would gladly agree to do, but said he would take care of it "after later." Which of course, never came. That's the beauty of "after later." It never comes! That is also the curse.

This year, it seems that just doing the basics is all that can be expected, maybe more. There is so much uncertainty. So many barriers. Doing anything extra? We will get to that later, when the virus is under control and the economy is better. After things get back to normal. After later.

But what if things never get back to normal? Or not for a very long time. That's the flaw in waiting for a future that can only vaguely be described. Will we know when we see it?

Thankfully, not everyone waits. Each of us had to pause, step back, and observe what was working and what was not. But then a lot of people got right back to it. For that, I would like to recognize them.

After our May conference was canceled, the organizing committee for the Dick Thomas Student Competition barely missed a beat. Dan Miller and Taylor Dixon took our competition for student GIS presentations virtual, ensuring that excellent work and effort at the college-level is recognized and rewarded. We'll host the contest again in May 2021, with a total of $750 to be awarded to the top 3 winners.

In September, our Professional Development committee, led by

(*Continued on page 2*)

ALSO IN THIS ISSUE

WAURISA Announces New Drone Special Interest Group (SIG)

By: Peter Keum, King County and Joshua Greenberg, Skagit County

There's a new SIG in town - WAURISA recently created a new Drone Special Interest Group (SIG). WAURISA members can now participate in learning and sharing information about integrating drones with geospatial workflows. Topics range from hardware and software to program implementation, to the fascinating aerial maps, 3D models, multispectral images and other data products

(*Continued on page 18*)

(President's Column; continued from page 1)

Maria Sevier, combined forces with one of our vendors to conduct two online ArcGIS Pro workshops. We hope these will be the first of many future online workshops.

Not to be outdone, our Washington Government GIS Leaders (WGGL) special interest group has launched a speaker series. If you are a leader in a local government GIS, send an email to wggl@waurisa.org to contact the WGGL chair, Josh Greenberg, and become a member of the group.

If you really need to get out into the great outdoors, you might consider flying a drone. Don't know how to do that? As luck would have it, WAURISA has joined forces with Peter Keum to launch a special interest group for Drone enthusiasts. Sign up for the mailing list on the WAURISA web site: https://waurisa.org/Drone-Special-Interest-Group

We had not seen many examples of virtual conferences in May, when our conference was to be held, but recently local colleagues have shown that it can be done successfully. The Northwest GIS User Group successfully conducted an all-virtual conference in October and just last week the State of Washington hosted a three-day GIS Day Washington State Joint Agency GIS Week.

During a year that has seemed like one long slog, when it has been a struggle to muster the energy to do much of anything, no one could be blamed for pulling off to the side and waiting things out. But there are many in our local GIS community who continue to push forward, pulling us all along with them. By adjusting to these abnormal times, we are creating a new normal. ■

Do you have an idea for a worthwhile article, but you don't want to be in charge of writing it? Let us know and we'll investigate it—we have willing writers that can turn your lead into a great story for the newsletter!

Contact us at summit@waurisa.org

A Conversation with WAURISA
Summit Person-of-the-Year Award Winner, Josh Greenberg

By: Don Burdick, for the WAURISA Summit Newsletter

The COVID pandemic may have put a real damper on the WAURISA Washington GIS conference this year, but that didn't mean that the board and volunteers weren't busy moving the organization forward to next year while acknowledging the past year's accomplishments of professionals, students, and volunteers.

One of those acknowledgements is one I personally had the honor to present-the 2020 Summit Award for the GIS Person-of-the-Year to Dr. Josh Greenberg. The presentation of the award was during the 2020 WAURISA membership meeting which normally is held during lunch on the last day of the annual conference, but this year was hosted via a Zoom meeting. I had the honor and privilege to present the award to Josh at his home, with his family and his boss, Geoff Almvig, present. It was a touching occasion for everyone. A few weeks later I was able to go back and sit with Josh out in the yard of his wonderful home to have a socially distant conversation about the Summit Award. Josh shared his experiences in GIS and his thoughts for other GIS professionals and students. The following conversation has been edited for clarity and brevity (not because Josh likes to talk… a lot!).

Josh Greenberg's kids, Ellie and Adam, made him an awesome sign to celebrate his award.

Don: Congratulations on the 2020 Summit Award, I truly enjoyed the opportunity to present it to you and to be here in person. So, what do you think of being the 2020 GIS Person-of-the-Year?

Josh: Well, it's certainly an honor, especially coming from an organization that I love participating in, and knowing who the previous award winners have been. It was a nice uplift during a somewhat disappointing time for WAURISA. I truly enjoy attending the conference, and miss the ability to get together, be social and reconnect with the diverse professionals in the industry.

Don: Do you have a special location where you plan to keep the award?

Josh: So far, it's at work. Just because normally that's where I would be all the time looking at it. I have it on my shelf at work, along with a few other tokens of thanks, right next to all my conference swag from over the years.

Don: Will you share with our Summit readers how you got your start in the profession, how you wound up working for Skagit County and how that position has evolved over time?

Josh: I started in college wanting to be a veterinarian. I was in the pre-vet program, but I wasn't enjoying my classes very much, which was odd because I love school. I didn't have a natural aptitude for the requirements, and after two years I started to realize I may not be suited for the profession. I was just getting started and it already felt like an uphill battle.

I took an elective which was a geography class. It was an introductory physical geography class and the professor would point out physical features in a slideshow and then we would look at them on the topo map and he would explain how they were created and how to read topo maps. Every day I looked forward to that class. So I thought, "I'm going to take another geography class."

Traditionally, all the way up to college, I hated geography because it was a lot of memorization and I have a horrible memory. Remembering states and capitals and trivia was not anything I ever enjoyed. So, all of a sudden I thought, "Well, this is a type of geography I had no idea I enjoyed!"

I took a cartography class and it was old-school cartography with

(Continued on page 5)

URISA Fostering Excellence in GIS www.URISA.org

GIS Leadership Academy

Popular URISA Program to be Offered in the Pacific Northwest in 2021

Minneapolis, MN—June 7-11, 2021
Portland, Oregon—August 16-20, 2021
St Petersburg, FL—November 8-12, 2021

5 Days of Targeted GIS Leadership Training… Taught by GIS Leaders

https://www.urisa.org/education-events/urisa-gis-leadership-academy/

Leadership

(Summit Award Winner Josh Greenberg Interview; continued from page 3)

drafting tables and mylar. I absolutely loved it. I couldn't believe how much time I would put into one map and it just didn't bother me. I could put 16 hours into making one map and it was all fun.

I still wanted to figure out how to connect geography to environmental work. Even if I wasn't going to take care of people's cats and dogs, I had a huge passion for the environment. I took a landscape ecology class. This was in 1988, it was a very new field. I think some of the early works describing landscape ecology had only come out a few years earlier so it was exciting. It was new ideas and we used GIS. It was a Mac-based raster version of GIS. We would do these buffer questions and suitability questions and I thought I'd reached nirvana. I was like… this is so amazing; it's combining geography and my passion for protecting the environment and this whole concept of looking at landscape was going to save the world. Disappointingly it didn't, but you know, I had that vision as an undergrad.

In his spare time, you can find Josh kayaking on the water

I completed that class but there wasn't a lot more in GIS at that time. In fact, the geography department at University of Vermont didn't have a GIS program.

At that point I knew I wanted to do landscape ecology. The professor who taught the landscape ecology course had been a postdoc at the University of Washington with Jerry Franklin. So he helped me write a letter to Jerry and I figured I'd go visit the faculty and see where I can get into grad school. I drove cross-country and visited a bunch of different schools. I'm pretty convinced that the letter got me in with Jerry Franklin because I was just an okay student, I wasn't anything spectacular. So, Jerry Franklin told me he'll figure out a way to have me in the UW program. At first, I was going to be working with another faculty member, but then it turned out he gave the position to a really outstanding student. So Jerry got stuck with me, but he never complained.

That's where I first took my first ArcInfo class. It was 1991 with Miles Logsdon and I loved it. I just couldn't get enough. I started working with ArcView 3.x and helped Professor Franklin.

I took his landscape ecology class. Then I after that I was his teachers assistant and a research assistant. I did a master's degree at University of Washington using GIS to come up with different ways of rank ordering preferences instead of just a linear system where you add things together. I used the kind of multi-dimensional spaces to find clusters of commonality and that was really fun.

And then I was thinking I was done with my master's degree and I'm going to go work. Jerry Franklin suggested I could do that, or I could stay on as a Ph.D. student. They offered me full funding and a lab to use. There were satellite images from around the country and he thought maybe I can come up with something interesting.

I ended up spending nine years at University of Washington, both on a masters and then a Ph.D. Thankfully, the University of Washington and the state covered most of the costs. They covered my tuition and they gave me a stipend. I always felt blessed. When you're in school it's kind of about you. You're learning, you're writing for yourself, you're trying new things. I mean, it just felt like it was a very selfish period, and I loved every minute of it and the wonderful people.

After graduating, my wife had a job up here in Mount Vernon so I couldn't move anywhere, so I couldn't go get a postdoc. I started doing some GIS consulting work and one of my big clients was Skagit County. Geoff Almvig there asked after about half a year, "What do you think about instead of consulting for us, we just hire you? I mean that might be cheaper for us and better for you."

So I had that opportunity to go full-time as a staff person and that was 19 and a half years ago. I started as a senior GIS Remote Sensing Analyst and that's where I am today.

Don: With your work at Skagit County are there any particularly exciting GIS remote sensing analysis projects that really stand out to you?

(Continued on page 7)

Summit Award Winner Josh Greenberg Interview; continued from page 5)

Josh: You know it's interesting, I started doing remote sensing and analyzing Landsat data to do land cover and I soon realized that most of the work we do at the county needs higher precision, higher accuracy data. We're not that interested in knowing 50% of the county is forested. I mean it's cool, but that doesn't help in our day-to-day management. So, my remote sensing experience quickly became finding the best way to get the best imagery for county staff to use. When I first started we had pretty coarse, 3 foot black and white imagery. We thought it was fantastic.

One of the first things I did was contract to get some color multispectral imagery with the Dais platform. Space Imaging made two satellites; one successfully went up [to orbit], and they didn't need the backup so they put it into a plane. Somehow, I had a connection and they came out and they flew all of Skagit County. That was the beginning and that was three foot multispectral and we thought it was the most amazing thing. Now we're contracting to do 2 inch oblique and ortho images for all of the cities and nine inch for the rest of the county and it just keeps getting better and better.

Josh and his wife Anita love hiking in the beautiful Pacific Northwest

Don: Many in their nomination statements mentioned your outgoing personality and proactive approach to reaching out and embracing GIS professionals throughout the state and bringing them together. What inspires that spirit in you?

Josh: I love connecting with people. I mean, I love GIS and I love my job, but on a different completely unrelated subject I just love connecting with people. I have found, and I think you probably find this too, that GIS people in general are great to connect with. You can cast the net towards GIS people and you're going to come back with very high success rates of great interesting people. I don't know what it is that makes us with varied backgrounds and varied outside interest be such wonderful people to be with, but that's been a big driver to meet all these people.

Don: During your keynote at the GIS Day 2018 presentation everyone saw the video of your mom when you asked her to describe what you do. You shared at the time the value of GIS professionals and how we might represent the profession. Would you like to share some of those thoughts?

Josh: I wish I had a great answer for that. I don't. I've been reading some different suggestions people have had, like Adam Carnow [*Community evangelist @ Esri],* or Brent Jones *[current URISA president]* and others where they say that we just have to phrase what we do in a common language. Part of what I wanted to make people aware of is that what we think is GIS is expanding. And even if it's not being called GIS, the spatial data and the use of spatial information is going on beyond the term GIS. It's going beyond even geospatial. How we embrace that and say that we're a part of that I don't know. I wish I had a better answer. I'm still horrible at defining what I say. I think about it a lot but I still say I make computer maps and work with databases. And I don't even have to finish saying databases and they're half asleep.

I do think it will keep changing. Certainly with COVID-19 and the Johns Hopkins dashboard, I think that really has made mapping very commonplace now. True GIS, not just autonomous vehicles and drones but true GIS now has meaning to it for everyone where they can see the benefits and impacts of mapping. But yeah, I think we just need to keep at it, and we need to keep trying.

Don: What kind of advice would you have to young professionals trying to enter or advance in the GIS profession?

Josh: Well, as you probably gathered for my earlier answers, networking is so important. I think a lot of young professionals recognize that about making those connections. So often that's how you find out about a job or an advancement or a new technique. There's certainly no end to information available on the internet, YouTube and the Esri website. I do think networking is really important and that's why it's been great for WAURISA to be so supportive of students. We probably could do more, URISA International has the Vanguard Cabinet which is again also great for networking and Esri has young professionals and I'd love to see us create that.

(Continued on page 9)

(Josh Greenberg Summit Award Interview; continued from page 7)

And then never stop learning. If you're not into learning the GIS profession is not for you. I mean it'll overwhelm you because it's evolving so fast. If you don't have a passion for learning and you don't actively practice it, whether it's conferences or online classes you will fall behind. There is no shortage of free learning opportunities, WAURISA workshops, all of that. I think those are key things to advancing for students and established professionals alike.

Don: When you're not working as a GIS geek, what do you like to do to keep busy or relax?

Josh: I pretty much keep geeking. I love to do an annual trip to the Consumer Electronics Show in Vegas to see what other geeky stuff is out there, both spatial and non-spatial. It's such a great networking opportunity, especially seeing and meeting people trying to make a break into the profession of technology with their ideas and being able to talk to them and see how they came up with those ideas like the robotic electronic mouse that the cats can chase.

We have two new kayaks and I love going kayaking. I have a new drone and I've been absolutely loving learning how to do drone videos and editing and narration. We spend a fair amount of time around the house, which is very convenient these days, just gardening, cooking and growing things in the greenhouse, walking the dog, taking care of our goats. And always trying to make a better pizza.

Don: It's been a pleasure speaking with you. Any final thoughts?

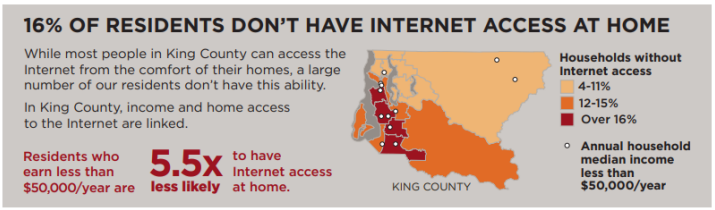
Josh: Just that I think, like many people, I'm looking forward to when we can get together again as WAURISA GIS folks in the state. How cool it is that we have a pretty solid foundation so that we can weather a storm like this both financially and emotionally. We know that when it's done we will all still be friends and will all be colleagues that can work together. Also that we need to really embrace the change. I mean it is a horrible tragic pandemic, but at the same time a portion of change will be here forever. I think this will transform how we work and meet. We need to continue to advance what WAURISA does and how we serve our members and how we connect, probably more than just Zoom meetings. I mean we are technology folks. We need to start thinking about how we can continue what we have been doing but maybe just more safely. For example, I love our board meetings now because you can see everyone. That's so cool. But mostly I am just looking forward to being together with everyone. ■

Equity and Social Justice in the GIS Profession

By: Eadie Kaltenbacher, Kitsap 911

The summer of 2020 was dramatic. With the COVID-19 pandemic raging, Americans took to the streets to affirm that Black Lives Matter. How are GIS professionals in Washington State participating in this movement?

Some seeds of action were planted well before this summer. In November 2019, Greg Babinski (King County's GIS Marketing & Business Development Manager) was named an Ethical GEO fellow of the American Geographic Society in order to develop best practices in the field of Equity and Social Justice (ESJ) for GIS. He has also been leading workshops in ESJ for GIS professionals, and administers the LinkedIn GIS for ESJ group (join here). I asked Greg for some specific examples about projects where GIS was used for ESJ, and he explained to me that I need to think about ESJ as a much broader concept. He likens ESJ to a lens through which we see the world. We shouldn't simply pick a couple of layers and apply ESJ to them, we need to integrate ESJ throughout our worldview. However, when pressed, he did share with me that King County has created a Digital Equity Infographic:



A portion of King County's Digital Equity Infographic

This kind of information is critical as governments plan out how to adapt to the changing necessities imposed upon us by COVID-19. With workplaces and schools depending on employees and students to engage from home, these kinds of dashboards will illustrate where the need for broadband, hotspots, and other digital infrastructure is greatest.

Who is responsible?

Nicole Franklin wants GIS professionals to push beyond their comfort zone past these kinds of analysis. Franklin, currently a

(Continued on page 10)

(ESJ and GIS; continued from page 9)

consultant with an anti-racism organization, and the former Chief Equity Officer for King County, outlined a three-phase framework for GIS and ESJ. In the first phase, GIS is used to perform spatial analysis, asking questions like "where are the inequities?" and "where are the greatest needs?" She notes that many of these analyses show similar results. Questions such as "where is infant mortality the highest?", "where is there income disparity?", "where do Black children live in poverty"…the answers to many of these questions point to the same locations.

In the second phase, organizations can begin to take action, such as planning locations for free or reduced lunches based on locations identified in the first phase. Franklin believes this is our current stage as a profession.

She also proposes a third stage, one in which ESJ is integrated into every GIS initiative. She explained that ESJ is a component of every discipline, from earth science to healthcare and beyond, and should be considered within the design of each GIS application. Some suggestions she has are:

- Challenge yourself to step out of the technical role, and advocate for your beliefs.
- Make sure you allow for a two-way conversation with your "customers." Too often, we publish a map or analysis and consider the project done. Create space for feedback from the users.
- Teach other professionals what you have learned. Have you addressed an inequity concern? Share your knowledge with others by writing an article or giving a presentation.

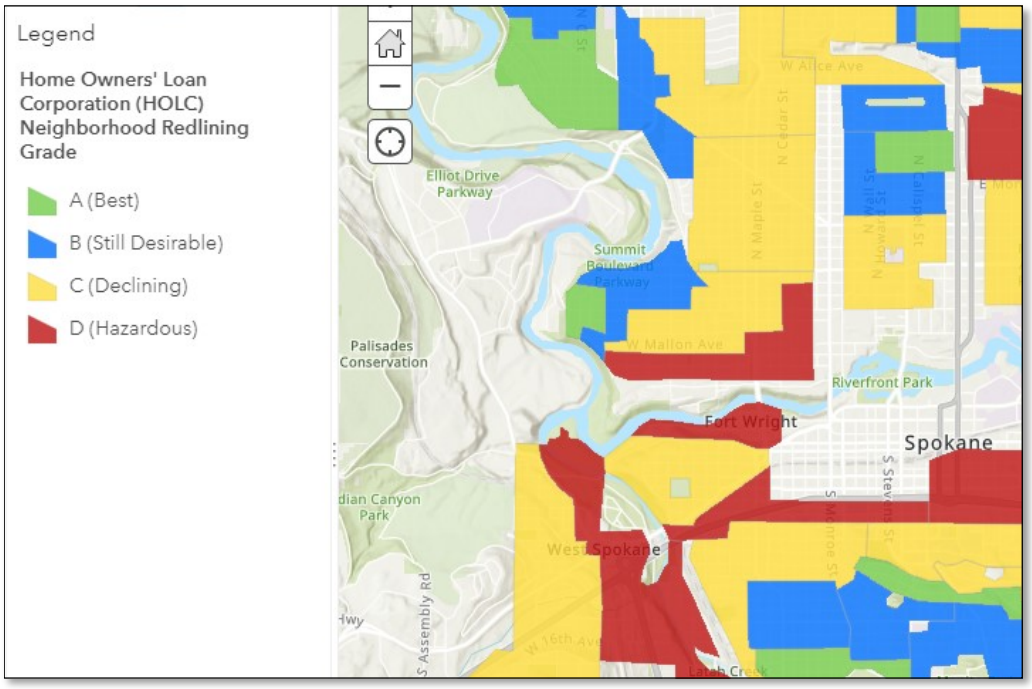
Get Inspired

Esri has developed a Racial Equity GIS Hub to provide data, showcase applications, and share solutions developed by users. Examples of the applications in this hub tell stories of individuals (The Life of Dolores Huerta), while others recount the history and lasting impacts of inequities such as redlining in local communities (Mapping Racial Equity in Asheville, NC).

Further, Esri has added a layer to their Living Atlas for HOLC (Home Owners' Loan Corporation) Neighborhood Redlining Grade. The history of redlining is complex, but in a nutshell these maps were historically used to rank neighborhood quality, including the racist practice of illustrating "undesirable populations." For Washington State, data for Seattle, Tacoma, and Spokane are available, and this blog post provides some ideas on how it can be used.

In my latest mapping project, I was asked to display some incident data. I did this and also added a Social Vulnerability layer from the CDC that I found in the ArcGIS Living Atlas. It provided some context as map viewers looked at the incident data and began planning what steps to take next.

One item I learned from speaking with these experts is that nobody has all the answers to these complex problems. There is no simple solution, and in fact, nobody even really knows what a solution will look like. My takeaway was to just take one small step at a time, and keep educating and challenging myself. I hope you are inspired to do the same. ■



Esri's Living Atlas Layer—Home Owners' Loan Corporation Neighborhood Redlining Grade

Improved Business Sponsor Program Now Available

By: WAURISA Board of Directors

The WAURISA Board of Directors is excited to announce our new Business Sponsorship program! In the past, most businesses became WAURISA sponsors by exhibiting at our annual GIS Conference. This has always been a critical component of the conference, giving attendees an important opportunity to learn about new technologies and services. While exhibiting at the conference included company exposure on our website and advertising in our quarterly Summit Newsletter, the essential benefits of your marketing were tied to the annual conference. Our new Business Sponsorship program provides a way for you to keep in front of our members and the greater Washington State GIS community all year, at an affordable price.

These new sponsorship opportunities run January-December and includes the option of an article featuring your business in an issue of The Summit Newsletter, among many additional benefits (see list on right). Business sponsors also receive a discount on conference exhibitor rates. Our business community is a fundamental component to the success of the GIS industry in Washington state and WAURISA wouldn't be here without you. We hope you agree and find our new program to be an affordable and effective way to support the Washington GIS community.

To sign up, please first review registration instructions at https://waurisa.org/Sponsor-Program-details. Be prepared to upload your business logo and a company description (100 word maximum). Next, email our Business Sponsor coordinator, Heather Glock Vendorsupport@waurisa.org, to receive instructions for submitting your advertisement and article for inclusion in The Summit Newsletter. Heather can also answer any questions you have about these new sponsorship opportunities.

Option One: Business Sponsor:

- Cost: $150 annually for January-December sponsorship
- Includes WAURISA membership for one business individual
- 1/4 page business ad in 4 issues of the WAURISA Quarterly Summit Newsletter (circulation 3,000+)
- 250 word article (e.g., case study, topic of expertise) in one issue of the Summit Newsletter
- Company logo and business description included on our website and in the Summit Newsletter "Supporting Vendor Page"
- Logo displayed and recognition given at the beginning of all WAURISA-sponsored conferences, trainings and workshops
- Discount on Washington GIS Conference exhibitor rates

Option Two: Business Plus Sponsor:

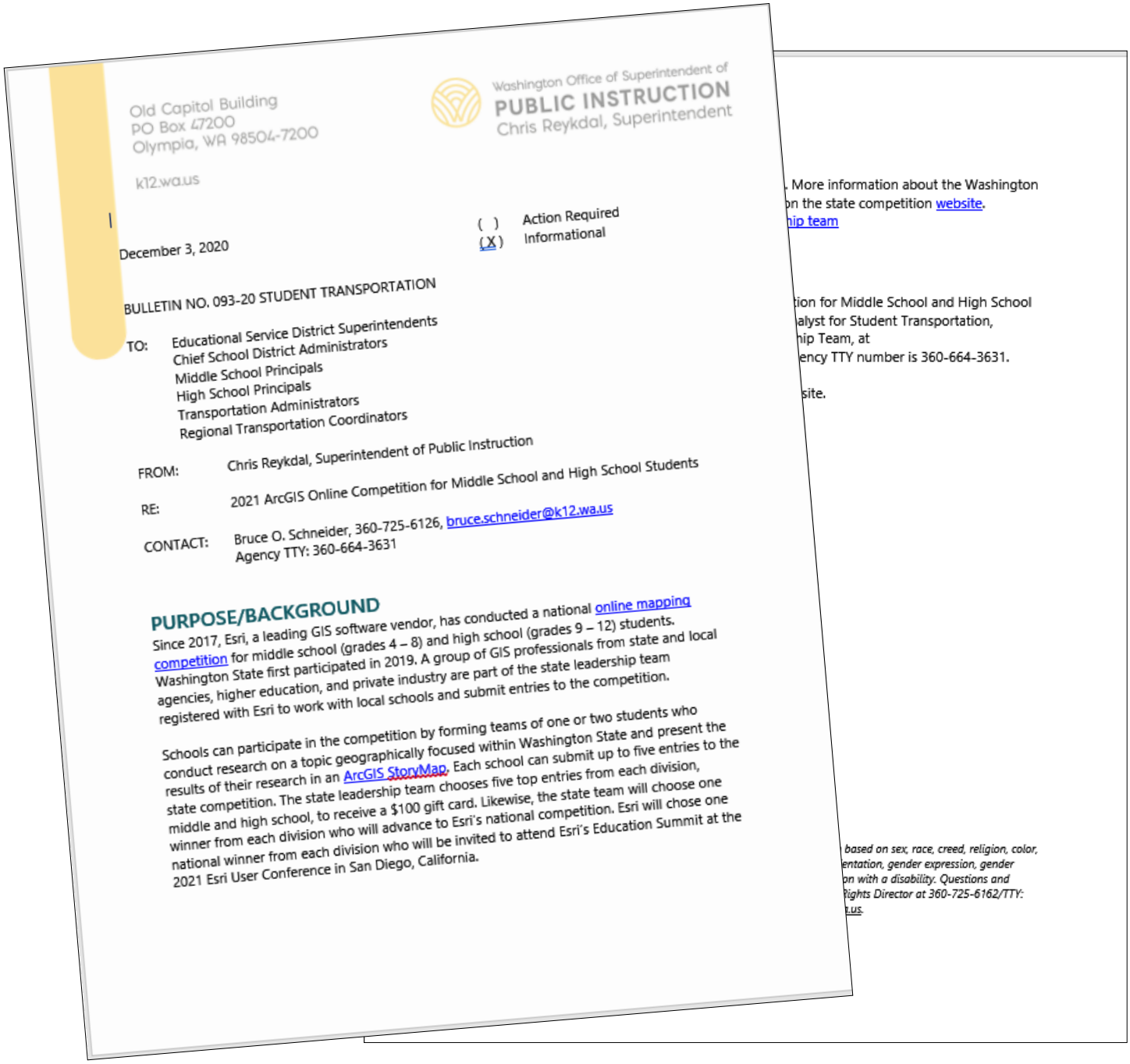
- Cost: $225 annually for January-December sponsorship
- Includes WAURISA membership for one business individual
- Full page business ad in 4 issues of the WAURISA Quarterly Summit Newsletter (circulation 3,000+)
- 500 word article (e.g., case study, topic of expertise) in one issue of the Summit Newsletter
- Company logo and business description included on our website and in the Summit Newsletter "Supporting Vendor Page"
- Logo displayed and recognition given at the beginning of all WAURISA-sponsored conferences, trainings and workshops
- Discount on Washington GIS Conference exhibitor rates

WAURISA Business Sponsorship	Annual Dues	Individual Membership	Logo and Description on Website and in Summit Newsletter	Summit Newsletter Ad	Summit Article
Business Sponsorship	$150.00	1	Yes	quarter page, 3-4 issues	250 words and up to 2 images in one issue

Business Plus Sponsorship	Fee				
Increased Summit Newsletter Visibility	$75.00	-	Yes	full page, 3-4 issues	500 words and up to 4 images in one issue

Washington State Schools to Participate in Esri ArcGIS Online Contest for the 3rd Year in a Row

The Washington State Office of Superintendent of Public Instruction (OSPI) has announced their participation in the 2021 National ArcGIS Online Competition for Middle School and High School students. This will be the 3rd year Washington schools have participated in the contest. OSPI, WAURIA, and Washington Technology Solutions (WaTech) work together as a leadership team to support the contest, where students (independently or in groups of two) analyze, interpret and present data via an ArcGIS web app or story map. Each participating state receives 10 equal prizes of $100 for the 5 best high school and the 5 best middle school entries. The leadership team would like more participation from the schools on the east side of the state. To learn more, check out OSPI's contest StoryMap. If you know of a teacher or student who might be interested in the contest, and/or if you would like to support a participating teacher or student, please email Bruce Schneider at bruce.schneider@k12.wa.us. Do it for the kids!



Old Capitol Building
PO Box 47200
Olympia, WA 98504-7200

k12.wa.us

Washington Office of Superintendent of
PUBLIC INSTRUCTION
Chris Reykdal, Superintendent

December 3, 2020

( ) Action Required
(X) Informational

BULLETIN NO. 093-20 STUDENT TRANSPORTATION

TO: Educational Service District Superintendents
Chief School District Administrators
Middle School Principals
High School Principals
Transportation Administrators
Regional Transportation Coordinators

FROM: Chris Reykdal, Superintendent of Public Instruction

RE: 2021 ArcGIS Online Competition for Middle School and High School Students

CONTACT: Bruce O. Schneider, 360-725-6126, bruce.schneider@k12.wa.us
Agency TTY: 360-664-3631

PURPOSE/BACKGROUND

Since 2017, Esri, a leading GIS software vendor, has conducted a national online mapping competition for middle school (grades 4 – 8) and high school (grades 9 – 12) students. Washington State first participated in 2019. A group of GIS professionals from state and local agencies, higher education, and private industry are part of the state leadership team registered with Esri to work with local schools and submit entries to the competition.

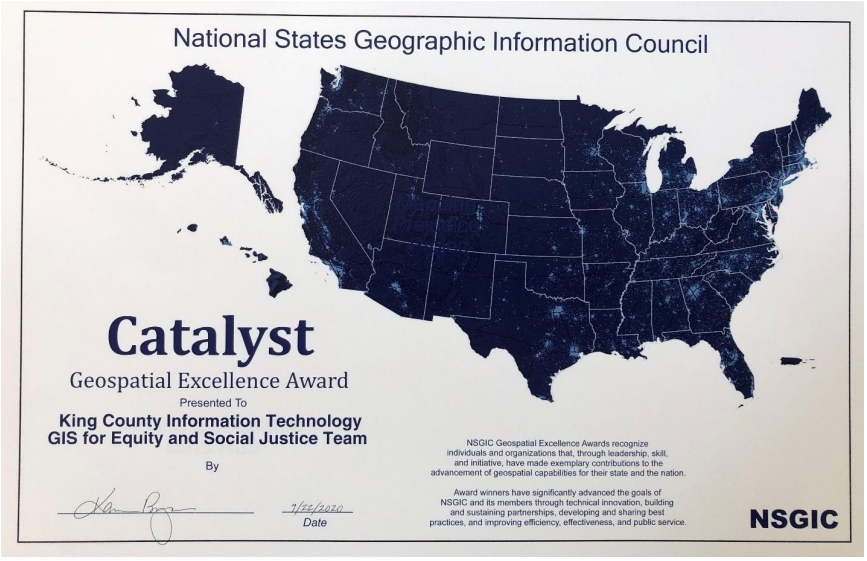
Schools can participate in the competition by forming teams of one or two students who conduct research on a topic geographically focused within Washington State and present the results of their research in an ArcGIS StoryMap. Each school can submit up to five entries to the state competition. The state leadership team chooses five top entries from each division, middle and high school, to receive a $100 gift card. Likewise, the state team will choose one winner from each division who will advance to Esri's national competition. Esri will chose one national winner from each division who will be invited to attend Esri's Education Summit at the 2021 Esri User Conference in San Diego, California.

King County GIS Receives Catalyst Award from National State Geographic Information Council

By: Joanne Markert, WaTech, and Greg Babinski, King County

At its 2020 Annual Conference, the National States Geographic Information Council awarded its GIS Catalyst Award to the King County Information Technology GIS for Equity and Social Justice Team.

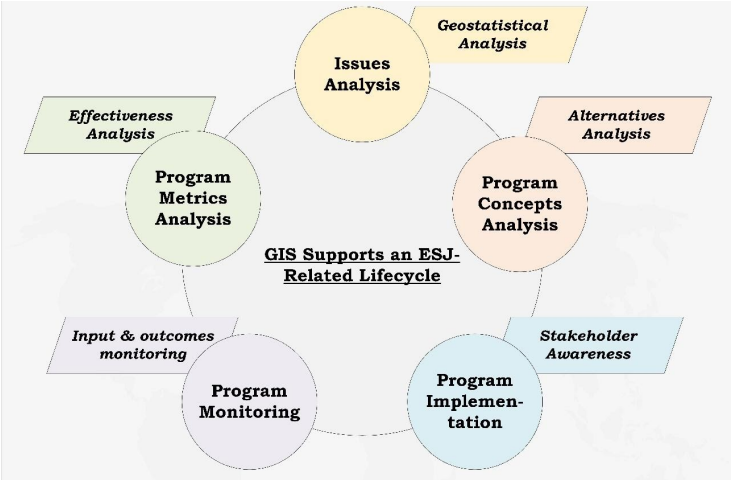
NSGIC promotes the coordinated, impactful, and cost-efficient application of GIS and other location-based information and analytics to best serve the nation, with emphasis on the power of initiatives and public policy that connect across local, state, federal, and private sector partners. The NSGIC Annual Conference was held September 21-25, 2020.



For 30 years, the NSGIC Annual Conference has been a meeting place for state GIS leaders to share successes and challenges; confer with federal, local, academic, nonprofit, and private sector colleagues; identify new opportunities; launch collaborations; contribute to NSGIC's growth and direction; and recharge.

Before each conference, NSGIC considers candidates for its Geospatial Excellence Awards in three categories: Champion | Catalyst | Innovator. Criteria for the wards include:

- Create a sustainable partnership or initiative that returns significant benefit from geospatial technology across multiple organizations
- Advances the 'create it once, use it a bunch' credo for efficiently delivering valued geospatial data and services across a broad enterprise of users
- Benefits the whole nation through sharing of innovation or establishment of best practices



- Promotes NSGIC goal of efficient and effective government through increased, prudent adoption of geospatial technologies
- The synopsis of the award application material stated:

King County IT's GIS for Equity & Social Justice Team has developed an innovative methodology to provide a new methodology for government agencies to analyze any policy, project or program. The KC GIS for ESJ approach is to use spatial data and geospatial analysis and visualization to identify where the needs are greatest related to traditionally underserved communities, and then to monitor the impact of programs to change conditions. The KCIT GIS for ESJ Team also developed a first ever half-day GIS for ESJ workshop and a peer-reviewed GIS for ESJ Best Practices document.

Where a person was born, or lives is a key predictor for achieving well-being through the course of a life. Race and space are interrelated. Current disparities across race and space in the United States is related to past policies and practices that disadvantaged communities of color. Analysis of the

(Continued on page 17)

(King County Catalyst Award; continued from page 16)

equity and social justice (ESJ) impact of public agency policies, projects, and programs is an emerging practice of King County and many other government agencies. GIS is a powerful tool to analyze social justice issues and help government agencies apply an equity lens to every aspect of their overall administration of public resources. An equity approach requires that we analyze communities where the need is greatest to achieve a future state where everyone in society can thrive and achieve well-being. GIS is a critical tool to identify disparities and focus resources to where the need is greatest.

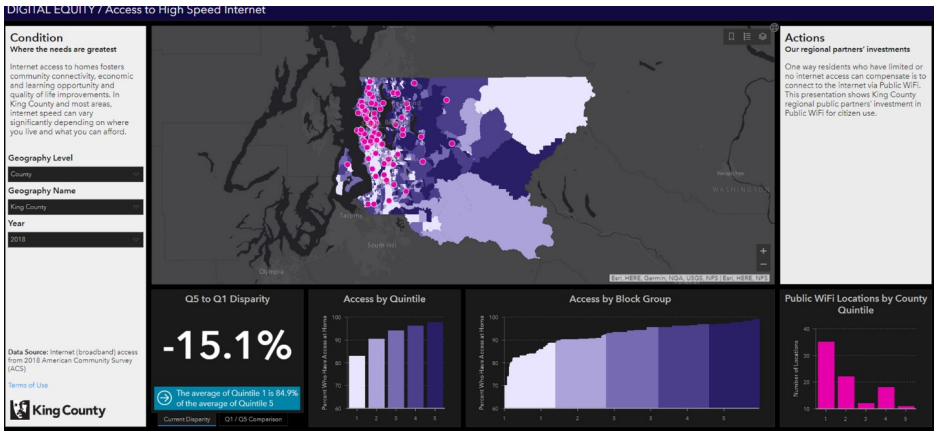
Specific activities that benefit not only King County, but the State of Washington, and beyond include:

We worked with Esri to develop a GIS based geovisualization dashboard that will be available for any agency to use via its Esri licensing. This dashboard will be used by King County throughout the lifecycle of each equity goal area. The dashboard template will be available through Esri as a new commercial product, to enable jurisdictions in any state to apply the same technology to their equity and social justice goals.

Throughout the course of our work, the King County IT GIS for ESJ team has looked beyond our jurisdiction and beyond the state of Washington to share and leverage our GIS for ESJ approach.

- *We led the organization of the first-ever GIS for Equity and Social Justice session at a GIS Conference (at GIS-Pro 2018 in Palm Springs)*
- *We facilitated the organization of the GIS for ESJ workgroup within URISA*
- *We developed the first ever GIS for ESJ half-day workshop in May 2019, which has since been presented 15 times to more than 350 students including sessions in New Orleans, San Jose, and Portland. Our online sessions attract students from across the US and Canada, and beyond.*
- *We established the GIS for ESJ LinkedIn group*
- *We participated with Esri and other jurisdictions to establish the first GIS for ESJ meet-up at the 2019 Esri UC. This has transitioned into a formal Esri GIS for ESJ SIG.*
- *Aided by an EthicalGEO Fellowship awarded by the American Geographical Society, we developed the first ever GIS for ESJ Best Practices document, which was peered reviewed and recently published and available for download on the AGS EthicalGEO website (https://ethicalgeo.org/greg-babinski/). This GIS for ESJ Best Practices has also been submitted to the GIS&T Body of Knowledge (https://gistbok.ucgis.org/) for publication as a new topic later in 2020.*
- *We have spoken about and shared our GIS for ESJ work in articles in the URISA GIS Professional, at the URISA GIS-Pro Conference and the Esri UC.*
- *We are working with Esri on the publication of a GIS for Equity & Social Justice book.*

Most recently we have been working with the State of Washington to help design and implement a Digital Equity Action Dashboard that will incentivize the build-out of broadband fiber and Wi-Fi hotspots to areas where the need is greatest, not only by the State, but also by other government agencies, non-profits, and the broadband industry, all to achieve equity and social justice.



The nomination of the King County IT GIS for ESJ Team for this award was first recommended by, Elizabeth Lanzer, Washington Department of Transportation GIS & Roadway Data Branch Manager. The nomination for the award was submitted by Joanne Markert, Washington State GIS Coordinator. Markert noted that "King County began this work before equity became a national issue. They have been leading on equity issues for our state and our nation and we are proud to nominate them for this distinguished award."

(WAURISA Drone SIG; continued from page 1)

that can be created. The timing is excellent as more local governments begin to formalize their drone programs.

Greg Lang from Pierce County and Peter Keum from King County created Western Washington Local Public Agency Drone Workgroup (https://westwadrone.github.io/) back in 2019 and had our kick-off meeting at City of Edmonds thanks to David Rohde, Edmonds GIS Specialist. Since then, we have met in Pierce County Admin Office in January of 2020 and twice through the Zoom meeting platform. We are going to continue our meetings, and with the help of Josh Greenburg from Skagit County, we now have SIG group within WAURISA to grow and learn to integrate with drone technology and geospatial field.

Our Drone SIG has simple goals:

- Hold regularly scheduled meetings (either in person or by teleconference)
- Organize workshops
- Share resources online
- Sharing of information among new and advanced users
- Help educate and introduce new users to the field of drone mapping and GIS

We want to invite current WAURISA members and invite new members to join and participate in this exciting new field. Our group was formed by members from many local western Washington agencies (cities, counties, and local tribes), but with help from WAURISA board members, we're looking forward to growing, sharing, and supporting all drone enthusiasts ranging from beginners to working professionals.

Please visit our Drone SIG webpage to learn more and sign up for the mail list: https://waurisa.org/Drone-Special-Interest-Group: https://waurisa.org/Drone-Special-Interest-Group

Greg Lang presents at a 2019 Western Washington Local Public Agency Drone Workgroup meeting. This group is now a WAURISA Special Interest Group.

Drone workshop attendees practicing their skills in the field.

Sound to Summit Regional GIS Project Update

By: Greg Babinski, GISP, AGS EthicalGEO Fellow

The Sound to Summit Regional GIS Project has initiated one-on-one assessment/interview/discussion sessions with agencies throughout King County.

Regional GIS Project Goals

The strategic objective of the Sound to Summit Regional GIS Study Steering Committee is to determine the best feasible way to organize and operate GIS services within the region to enable enhanced use and business effectiveness from GIS, increase ROI, and decreased cost. Now, during the time of Covid-19, with increased demands on GIS and each agency facing future budget issues, how to best collaborate and organize GIS in the region is of critical importance.

Regional GIS 1-1 Discussion Sessions

The Sound to Summit Regional GIS Steering Committee, comprised of volunteers from a variety of representative agencies, has already conducted extensive research on a range of options and scenarios for regional GIS. This work included researching the how, what, and why of other regional GIS entities throughout Washington, Oregon, across the U.S, and even into Canada. The Steering Committee researched future GIS technology trends, emerging applications, and the evolving nature of the GIS profession.

The current phase of the project involves sharing a summary of our initial research finding and discussing possible future regional GIS coordination, collaboration, and resource sharing scenarios. Most importantly, we want to hear from stakeholders in each individual agency. What is the state of GIS capability for your agency? What kind of ROI and other benefits are you achieving with GIS now?

What are the key priorities for your agency? What is your vision for GIS overall and how do you hope it will help with your key priorities?

Initially it was assumed that these sessions would be face-to-face in each agency's work location, but Covid-19 has changed that. Zoom has proven to be an effective and convenient tool to conduct these in-depth interview sessions.

As part of the individual Regional GIS 1-1 sessions, we work with each agency to:

- Understand the current capability and maturity level of your GIS
- Understand the quantifiable ROI that you are achieving with your GIS
- Understand any GIS-related issues or limitations
- Share your long-term GIS goals and vision
- Consider viable options for enhanced regional GIS collaboration and resource sharing
- Explore your interest in possibly pursuing any viable options for future regional GIS

After each individual agency Regional GIS 1-1 session, we provide a written summary report that will provide a high-level assessment of your GIS and discuss possible regional GIS options for future collaboration. Even if an agency goes no further with Regional GIS collaboration, the 1-1 session report is a valuable objective third-party analysis of its GIS operations.

What happens after the one on one sessions are completed?

There are potentially more than 40 agencies that will be contacted as part of this effort. After all the individual interviews are complete and the agency reports issued, the Steering Committee will convene for a series of workshops. These workshops will analyze and report on the individual input as a whole. How does our region stand in terms of GIS capability, our GIS management operations and maturity levels, and what does our ROI look like?

The workshops will then craft a document that reports on what we have learned, but more importantly make recommendations for the future. The report will identify a recommended option for Regional GIS, with rationale for the recommendation. It will also suggest an alternate option and analyze the consequences of keeping the status-quo.

The Sound to Summit Regional GIS Steering Committee has representatives from the following agencies: cities of Bellevue, Covington, Enumclaw, Kent, Kirkland, Mercer Island, Renton, Seattle, plus Sammamish Plateau Water, Snoqualmie Tribe and King County.

To learn more, contact Sound to Summit Regional GIS Steering Committee Chair Greg Babinski (greg.babinski@kingcounty.gov), and read Greg's two blogs about the project: Sound to Summit Regional GIS Project and Sound to Summit Regional GIS Discussions Are Underway

Washington Women in GIS and Technology: Member Spotlights

By: Jennifer Radcliff, City of Tumwater. WA

The Washington Women in GIS and Technology group was the brainchild of two amazing women, Amber Mikluscak and Renee Opatz, who helped get us started and created a thriving group. Tonya Kauhi is our current leader, and if not for all her coordination and hard work, we may have fizzled out. We wouldn't be the group we are today without these women, so in this issue we'd like to highlight two of them (and will highlight the third in a future issue). Jen Radcliff recently asked each of these ladies a few questions to get to know them a bit better.

Amber Mikluscak

Q. Why did you get involved with WWGT?

I started working in GIS in 2003, when my former company was just beginning to adopt the technology and the world was getting to know ArcGIS 8.3. All my early GIS mentors were men, and often I was the only woman in the room, on the team, or at the training. At geospatial conferences over the years, I've always looked for the "women's table" at lunchtime, hoping to share knowledge and stories with other geospatial professionals like me. I got involved with WWGT because the group began over one of those lunchtime discussions.

Q. Describe something you have completed recently for which you are proud?

Last spring, I received a grant to put together an art exhibit that used geospatial technology to explore the relationship of textile waste and consumerism to social equity. The exhibit was just a weekend pop-up, but the public was really engaged, and the response was amazing. It was an off-the-wall idea, and I'm proud that it came together successfully.

Q. Discuss a recent challenge and how you overcame it.

Through my work as a landscape architect and my life as a city-dweller, I became interested in how landscape characteristics influence social and environmental equity in urban environments. I designed a geospatial model to explore the relationship further, and I wrote grant proposal for funding. It's the first time that I've outlined a geospatial study this intensely for a passion project that is outside of my job, and it was definitely a challenge to complete! I didn't get the first grant (so maybe I haven't really overcome this yet), but I'm still trying. It would be an exciting study!

Q. What is one thing you want people to know about you?

That I love talking with people about big ideas and workshopping possibilities. I love that the geospatial community is constantly evolving and innovating. Of all the "GIS professionals" that I know and meet, very few of us do the same thing. It's pretty incredible.

Tonya Kauhi

Q. Why did you get involved with WWGT?

At the time the group was created, most of the meet-ups I attended primarily consisted of drinking beer and learning open source software skills which I did not use in my daily job. Open source software is amazing but not something I needed to add to my professional skill set. Also, most meet-ups did not offer opportunities to learn soft-skills such as networking, personal branding, communication, attitude and mindset, etc. which I was really interested in learning. The WWGT group tries to focus on what our members want to learn. We ask members what they want to learn and then do our best to focus on those items. I also think having a women-centric group is important as it allows women to share their experiences and knowledge in a supportive

(Continued on page 22)

(WWGT Member Profiles; continued from page 21)

place. It is vital that women working in the STEM fields feel supported and inspired as they navigate their career and for a lot of women these type of networking groups provide that support.

Q. Describe something you have completed recently for which you are proud?

In November, I delivered the keynote at the Washington State Joint Agency GIS Day. Generally, the idea of public speaking keeps me up at night and just being called a "keynote" made it even more terrifying, so my first thought was to decline the offer. However, I realized (with the help of a friend and a life-coach) that all those amazing people who deliver keynotes at conferences and events are just people and are just like me and you. If I declined the offer, I would miss an opportunity to share my passion and why I love doing what I do. I have learned to say "Yes" to things especially if they are scary or make me uncomfortable because these are the areas with the most opportunity for personal growth.

Q. Discuss a recent challenge and how you overcame it?

Finding a work-life balance during the pandemic was definitely a challenge for me. While I am so fortunate to be able to work from home, I prefer to work in the office. When the stay at home order took effect and we had to work from home, I did not even have a desk or work area at home. Also, I hardly ever left my computer and checked my work email constantly since I was worried about my supervisor thinking I was goofing around at home, so it felt like I was always at work. It took about two or three weeks for me to figure out a strategy that worked for me. I established a desk and designated work space, kept my morning routine the same as when I was going into the office daily, made sure to take short wellness breaks throughout the day (just as you would go grab coffee or have a quick chat in the office), when possible kept my normal work hours, closed my computer at the end of the day, and most importantly just take it one day at a time.

Q. What is one thing you want people to know about you?

I love helping people connect and learn something new. Great things can happen when people with similar interests connect and work towards a common goal, that is how you change the world!

The Washington Women in GIS & Technology (WWGT) group was created for women working in GIS and technology to meet, network, brainstorm and learn from one another. The group includes GIS students and professionals across all skills levels and disciplines. We meet monthly around Puget Sound (now virtually) to network and share ideas, industry information, experience, and advice. The group is open to join, and we welcome new faces. To view upcoming WWGT events refer to our website: wawomeningis.com or email Tonya Kauhi at wawomeningis@gmail.com.

2021 Dick Thomas Memorial Student Presentation Competition

By: Taylor Dixon and Dan Miller, WAURISA Community Engagement Committee

The annual Richard 'Dick' Thomas Memorial Student Presentation Competition and Award (DTA), will take place once again next spring! The competition was established in 2006 to honor Washington State GIS pioneer and mentor Richard "Dick" Thomas. The intent is to continue Dick's work of encouraging students to excel in their studies and transition successfully into careers in the field of GIS. WAURISA's objective is to inspire students to present their original work related to GIS, geography, or geographic research. The DTA Student Presentation Competition will be an online competition again, scheduled for May 20, 2021 (date subject to change).

Competition Information: The DTA competition is open to all currently enrolled students, and students who have graduated or completed classes within the last year (projects presented need to have occurred while students were still attending school). Presentation abstracts will be accepted from March 1 to March 31, 2021.

Prizes: First Place $500, Second Place $250, Third Place $125

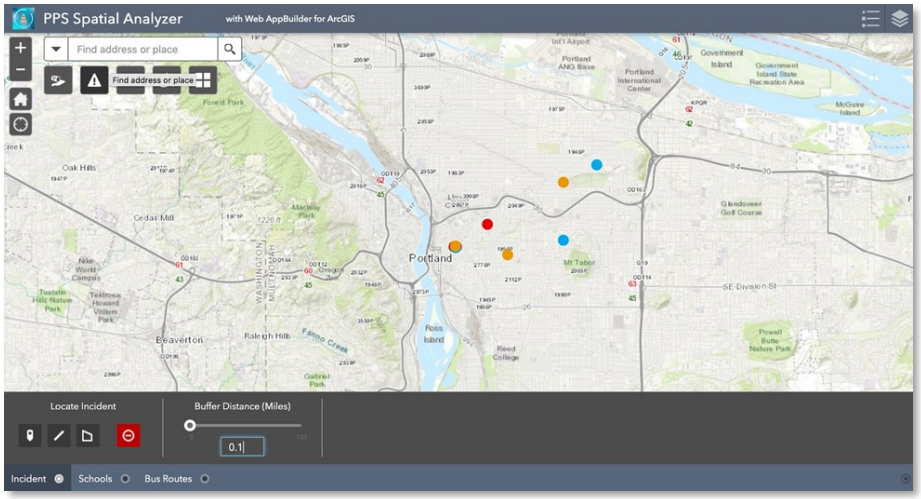
For more information: visit https://waurisa.org/Awards Contact the DTA Coordinator at dta@waurisa.org

GIS Platform Enhances a School District's Incident Management

University of Washington Students Develop Application for Portland Public School District

By: Brian Rafferty, Mareya Welsh, Horace Hou, and Sydney Hall, University of Washington

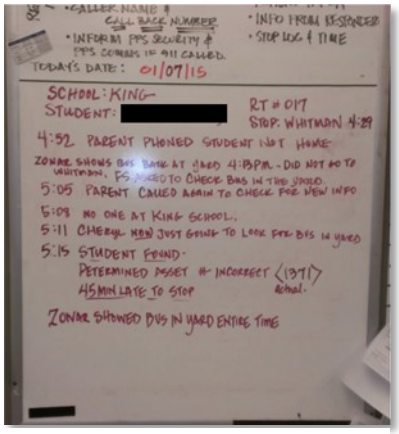
Portland Public Schools (PPS), located in Northwest Oregon, has just under 50,000 students enrolled in their 85 schools, and many students rely upon district transportation to get to school every day. Effective and rapid response to transportation incidents is necessary for PPS to best serve its students and to help ensure safety for the community at large.



Custom GIS applications will be used by one of the largest school districts in the Pacific Northwest, Portland Public School District, to bolster communication and increase situational awareness during incidents.

A Need for an Upgrade

K-12 school districts notoriously face challenges when attempting to update their toolsets due to budget constraints, and PPS is no different. The Transportation Department of PPS previously employed an outdated incident management system, which utilized whiteboards for documentation and emails for communication. Their existing system was not up to par since the whiteboards were not updated as often as necessary, and maintaining consistent communication via email can be difficult. Due to the coupled factors of having a strict budget and an outdated system, PPS's Transportation Department reached out to students at University of Washington's GIS Certificate Program to develop geospatial software that could address their needs.



Transportation incidents used to be tracked on white boards.

Designing the Backend

Before building any software, our team at University of Washington first had to meet with PPS to determine what data attributes were needed and how the new system should behave. We found that the Transportation Department wanted the GIS software to gather the same fields that were already being recorded with the whiteboard system, but they also wanted to include comment sections for each report. By having comment sections, PPS intended to bolster their ability to communicate effectively amongst departments when incidents arise. On a more technical level, we determined that PPS needed its incident data to maintain relations, so we dove into exploring how to implement the ArcGIS equivalent of a relational database management system (RDBMS).

We concluded that we needed to create Relationship Classes to successfully build a RDBMS with ArcGIS software, since Relationship Classes form a link between a single feature layer (a table containing real world objects) and an attribute table. The incident feature layers were designed with ArcGIS Pro, and were set to contain the same fields that PPS was already gathering via its whiteboard system. Multiple feature layers would need to be created since ArcGIS mandates that each layer be defined by a single geometry type. As a result, three possible layers were established, points, lines, and polygons to represent incidents. The field names of each feature layer were standardized to resolve potential complications when the front-end queries have contrasting geometries.

(*Continued* on page 24)

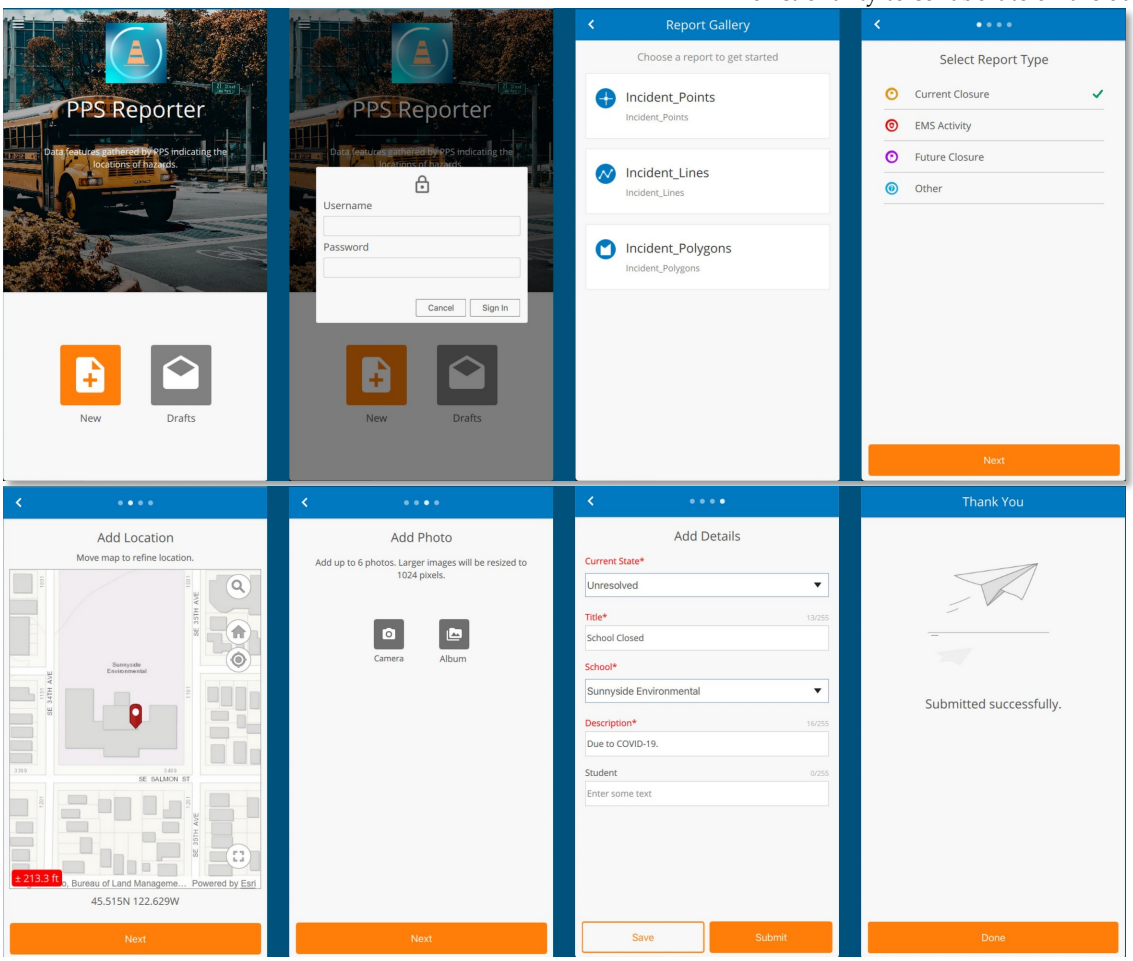
(Portland Public Schools Incident Management Solution; continued from page 23)

Once the incident feature layers were correctly implemented, we then established the comment sections. ArcGIS diverges from classic RDBMS structure by requiring separate attribute tables for each feature layer, so we created three identical tables to hold the comments. After the tables had been produced, we used the Relationship Class tool within ArcGIS Pro to forge three relations. With the relations created on our local machine, we then faced the task of figuring out a way to make our database dynamic and functional for a massive organization. To meet those needs, we elected to host the database on the cloud, since cloud services provide: synchronized views of the data between devices, encrypted storage that ensures security, automated procedures that maintain availability during disasters, and coordinated reads/writes that allow many users to collaborate on an incident at the same time. Due to the clear benefits that cloud services would offer PPS, we hosted the Relationship Classes on Esri's cloud service: ArcGIS Online.

Tools for Collaboration

Following the completion of the backend, our team's next mission was to implement user- friendly GIS applications to remotely collect reports and update data on the database. It was decided that a mobile application to submit incident reports would best fit PPS's needs, since such an app would take advantage of the cloud and significantly boost remote updates. We got started with the mobile app called the PPS Reporter, by augmenting a Field Reporter template application within AppStudio. Functioning as a digital form, the PPS Reporter asks the user a series of questions to indicate specific details regarding an incident. The mobile app is set up to connect with our Relationship Class's REST endpoint on ArcGIS Online, so once a report is submitted from a user's device, their information will upload to the cloud in real-time. By using the PPS Reporter, employees working in the field can rapidly communicate with PPS administration when incidents occur.

The mobile application we devised opened the doors so that PPS could swiftly collect reports, but now there was a need to add functionality to collaborate on the data internally. Our answer to that need was to create a web application called the PPS Data Manager, using ArcGIS Online's Web AppBuilder. The PPS Data Manager is hosted directly on the cloud, and acts as a frontend tool to visualize and comment on current reports that exist in the database. With this app, PPS has a mechanism to enhance their understanding of reports by utilizing the map to view where each incident occurred and the table to extract specific details. Once a report is selected on either the map or the table, the app will display a digitized rendition of their previous whiteboard system and the comments that



The district's new PPS Reporter solution is based on ArcGIS Online and allows employees in the field to rapidly communicate with PPS administration when an incident occurs.

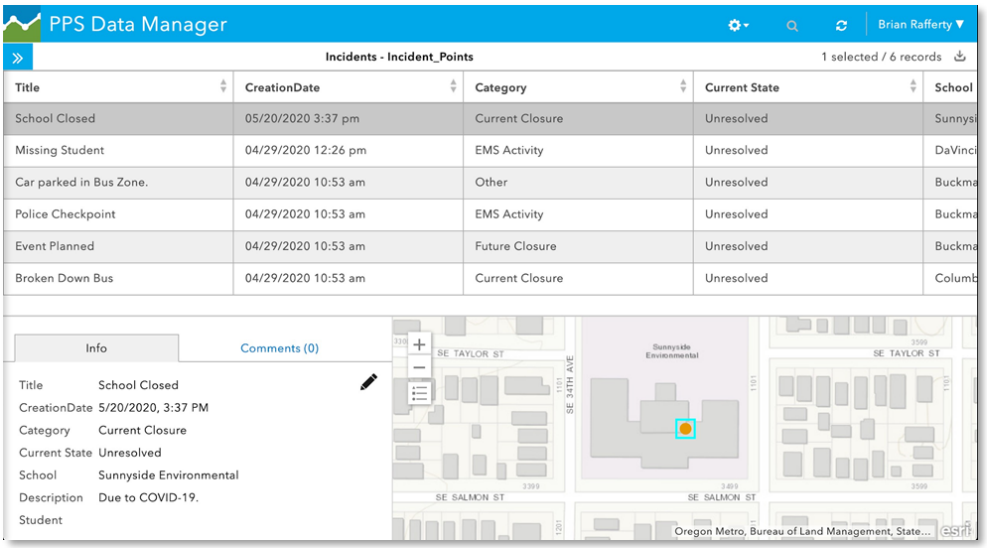
(Continued on page 25)

(Portland Public Schools Incident Management Solution; continued from page 24)

exist for the incident. From here, users of the web application can add comments of their own, effectively promoting an internal conversation to keep everyone up to date. By using these two apps, PPS now has tools in place to remotely collaborate across departments in times of need.

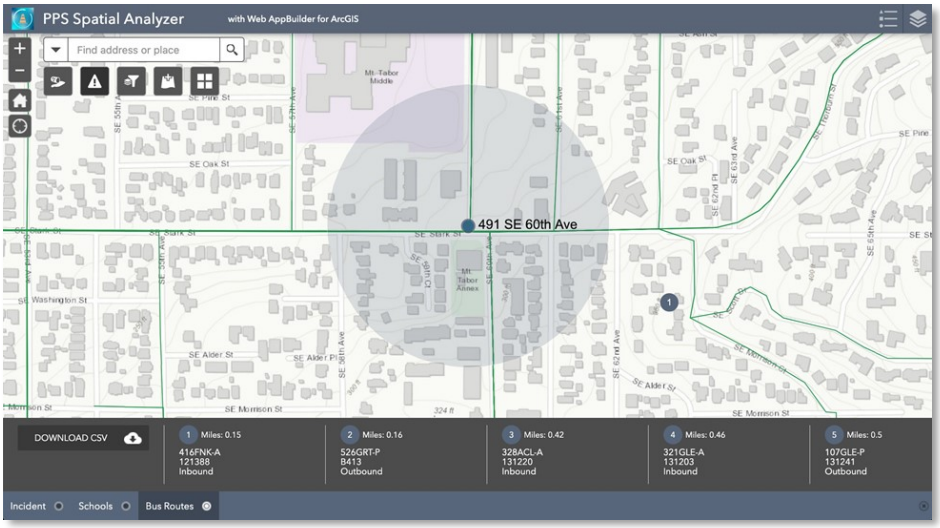
Streamlining the Workflow

Using the Reporter and Data Manager, PPS now has the means to efficiently produce an incident report and collaborate upon it, but we felt that GIS could be further utilized to help reach resolutions. That is where our specialized GIS application, called the PPS Spatial Analyzer, came into play. We developed this application with ArcGIS Online's Web AppBuilder, and established mechanisms to provide PPS with the information that they needed to act on incident reports. The Spatial Analyzer is a web mapping application, providing real-time incident report information that is automatically updated every 30 seconds. Beyond viewing the incidents themselves, some of the tools included in the web map provide the ability to: filter incidents on the map through a number of queries, view spill analysis for hazards, and determine lists of schools and bus routes that are impacted by a given incident. With the map and widgets, PPS can effectively use the Spatial Analyzer to respond to incidents that have occurred within their district.



The PPS Data Manager, an ArcGIS Online Web AppBuilder solution, enables staff to visualize and comment on current reports that exist in the database.

Beyond finding resolutions to incidents that have already occurred, PPS referenced their need for a system that could also help prepare for incidents that could happen in the future. PPS indicated that the most common problems faced by school bus drivers are unforeseen bad road conditions and local traffic along routes, so we added layers to display ground temperatures and current traffic congestion. With the extra layers in this app, we hope that PPS will be able to provide their bus drivers with the insights they need to avoid hazards altogether.



The district's Spatial Analyzer app provides real-time incident report information so staff can effectively respond to incidents within the district.

The three applications will allow the Transportation Department of PPS to maintain more effective communication and situational awareness. It is our hope that through the use of these apps at PPS, other K-12 school districts will see the benefits of GIS technology for incident response and will make a similar push to provide themselves with the best tools for the job. ■

Wildlife Crossing Site Selection in Whatcom County, WA

WAURISA's Dick Thomas Memorial Student Competition 2020 First Place Winner Project Summary

By: Megan LaFever, Ana Ledgerwood, Stacia Thompson, and Peyton Morrison, University of Washington, Professional Continuing Education Geographic Information System Program

In a single year, wildlife vehicle collisions (WVCs) cause over $8 billion of personal expenses to the U.S. population, 200 deaths, and 26,000 injuries, not to mention the damage to wildlife and habitat connectivity (ARC Solutions, 2017). Wildlife crossings are designed to help alleviate the physical and financial costs associated with WVCs, connect fragmented habitats, and decrease mortality rates of affected species (ARC Solutions, 2017). So why aren't there more wildlife crossings in areas with high density of WVCs? From our team's discussions with officials at Whatcom County and the Washington State Department of Transportation, we learned that the answer is complex. Various factors contribute to the problem including inadequate, outdated, or nonexistent data; lack of funding for data collection, analysis, and construction; and too little awareness of the issue on the part of the public. In our capacity as students of GIS, we provided geographic analysis that agencies can use to inform future wildlife crossing projects.

The goal of this project is to help Whatcom County find areas of high WVC and wildlife carcass removal density, signaling a pattern of WVC occurrences. In these areas of high density, the construction of a wildlife crossing would likely have a significant impact on wildlife behavior, diverting animals to use the designated crossing structure rather than a dangerous road. In order to maximize the potential for future construction of such a wildlife crossing, we will prioritize proximity to fish passage barriers (culverts, dams, and other structures that impede the movement of fish) that are slated for correction by 2030.

Our team compiled relevant traffic, wildlife, and terrain data to pinpoint problematic areas for WVCs within Whatcom County, WA. Using spatial analysis, we determined optimal sites for wildlife crossings across existing roads.

Our initial plan was to compile relevant ecological and traffic data from state and local agencies, select the most important datasets, and create several weighted overlay models for site selection using those datasets. We designed and built a geodatabase containing over forty datasets from Whatcom County, the Washington State Department of Transportation (WSDOT), the Washington State Department of Natural Resources (WDNR), the Washington State Department of Commerce, the Washington State Department of Fish and Wildlife (WDFW), and the United States Geological Survey (USGS), among other agencies and organizations. We sifted through this massive database and selected the most relevant data, focusing on WVC (WSDOT), wildlife carcass removal (WSDOT and Whatcom County), traffic (WSDOT), and habitat data (WDFW).

As we had expected, displaying the WVC and wildlife carcass removal data confirmed that all wildlife events were recorded along roads. Likewise, traffic data from the WSDOT is necessarily limited to roads within the state. It became apparent that our region of geographic analysis was not the land acreage of Whatcom County, but the linear network of roads within it. In GIS terms, our region of analysis was made up of lines, not polygons. ESRI's GIS software products contain a number of tools for analyzing patterns across planar areas, including hot spot analysis, cluster analysis, and density estimation. All of these pattern analysis tools calculate Euclidean distance, or straight-line distance between points in a Euclidean space. In layman's terms, these pattern analysis tools calculate distance "as the crow flies" across a plane. Our crucial WVC and carcass removal data are distributed along a linear network of roads, not across a plane. ESRI's software products also contain tools for calculating distances along a network, but these tools are limited to measuring distances, calculating routes, and generating directions. Its network analysis tools do not permit pattern analysis along a route. We determined that it is currently beyond the capabilities of ESRI software to analyze patterns within a network. To remedy this, scholars investigating patterns in linear network data have had to write their own network pattern analysis algorithms.

A team of GIS specialists at the University of Tokyo has created a toolbox of network pattern analysis tools for GIS interfaces: Spatial Analysis on a Network (SANET). The SANET team provides this toolbox to academic users free of charge on a case by case basis. We were fortunate enough to be granted access to the SANET toolbox by the team's leader, Dr Atsu Okabe. The toolbox includes a range of cluster analyses as well as interpolation and random point generation. Of particular interest to our project is the Network Kernel Densi-

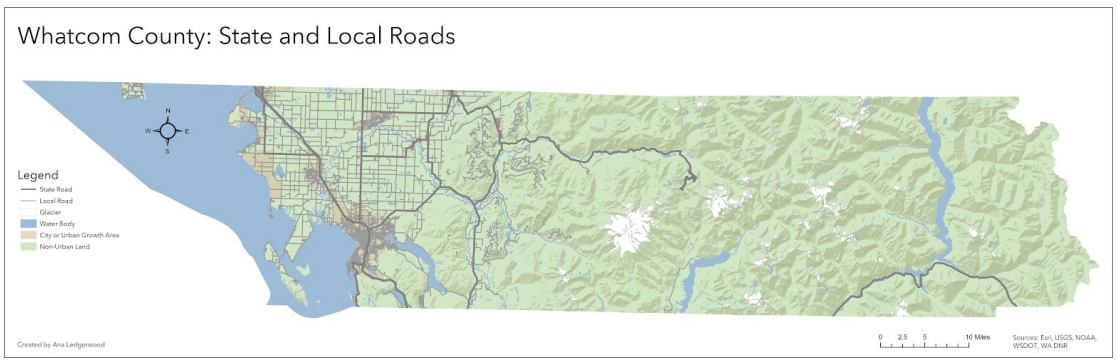
(Continued on page 27)

(Wildlife Crossing-DTA Winner; continued from page 26)

ty Estimation tool, which estimates the density of a set of points occurring along a linear network. We chose this tool as our primary analysis tool, as it would accurately calculate patterns in our network-constrained data. Unlike ESRI's planar Kernel Density Estimation tool, where the output is a raster, the output of the SANET Kernel Density Estimation tool is a vector. Vector data is easily scalable in ESRI software; it displays clearly at all scale levels. Were we to convert this vector output to a raster, we would lose much of the scalability and high definition of the data (not to mention fewer options for symbology and display). Rasters do not lend themselves to network analysis since line fluidity and definition is greatly reduced. We therefore chose to keep the output data from the SANET Kernel Density Estimation tool in vector format. This decision also meant that the weighted overlay site selection modeling we had originally planned on was no longer feasible. ESRI's Weighted Overlay tool requires rasters for input into the model. Its output is also in raster format. Rasters simply could not clearly display the results of our analysis while maintaining geographic accuracy and definition.

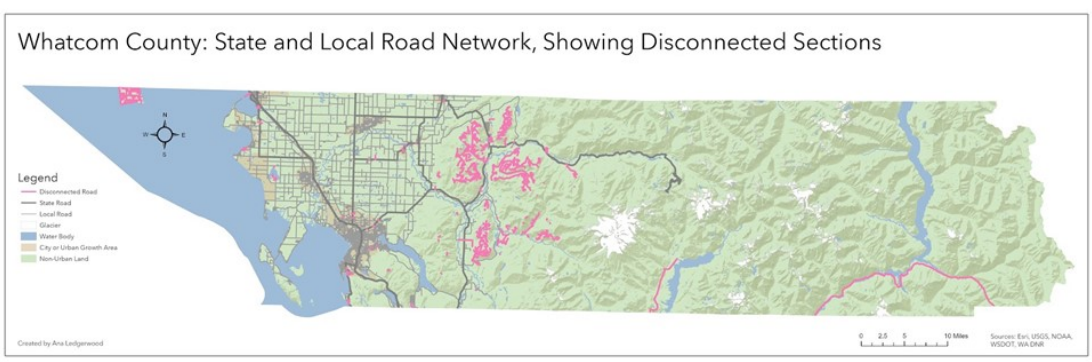
With the weighted overlay model no longer a possibility, we chose to focus and simplify our analysis: produce network kernel density estimation for two wildlife groups (all animals and elk), which could then be easily compared against existing data in vector format. To compare the network kernel density estimations to other vector data we would display each vector as a separate layer on a map. To run the network kernel density estimation, we selected our network: all roads within the Whatcom County boundary line (Figure 1).

Figure 1. Whatcom County: State and Local Roads



This network of roads is made up of state highways, state freeways, and local roads. We have symbolized the state roads with a bolder, darker line to distinguish them from local roads. Before the SANET software runs the Network Kernel Density Estimation tool, it must determine whether or not the selected network is completely connected. If the network is not completely connected a vector shapefile will be created showing linear sections disconnected from the larger network (Figure 2).

Figure 2. Whatcom County: State and Local Road Network, Showing Disconnected Sections



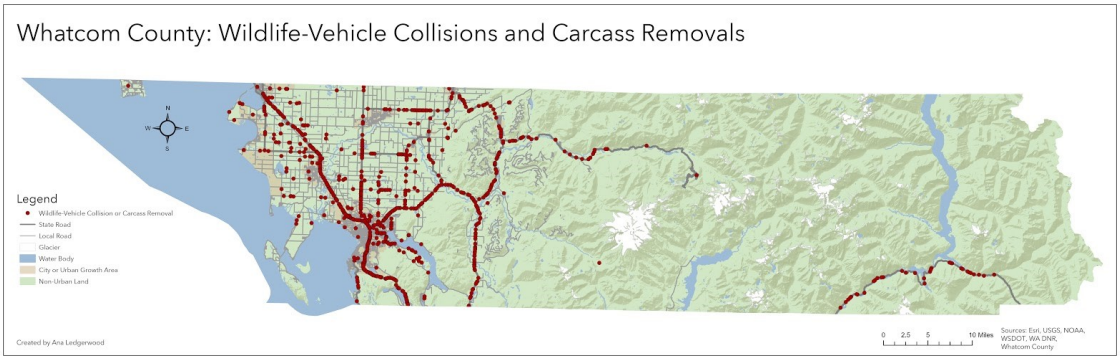
This map was created using the initial "warning" vector shapefile output from the SANET software, which highlights disconnected sections of the road net-

(Continued on page 28)

(Wildlife Crossing-DTA Winner; continued from page 27)

work. We have symbolized these disconnected sections in pink, with a thicker line width to distinguish them from the connected road network. These disconnected sections are primarily mountain access roads and sections of road that are in fact connected to other roads in Whatcom County, but which pass through Skagit County to the south. Another disconnected section is Point Roberts, which is only accessible by land from the rest of Whatcom County by traveling through British Columbia, Canada. These highlighted sections of road are not included in the SANET Kernel Density Estimation. We chose not to edit the road network data to connect these sections since they account for a relatively small subsection of the network. An examination of the wildlife-vehicle collision (WVC) and wildlife carcass removal point data also reveals that the vast majority of these wildlife incidents occurred on connected sections of the road network (Figure 3).

Figure 3. Whatcom County: Wildlife-Vehicle Collisions and Carcass Removals



This map shows all wildlife incidents, i.e. WVCs and wildlife carcass removals (which are assumed to be animal deaths from unreported WVCs). Since these wildlife incidents are discrete events they are symbolized as points. A close examination of the map reveals that the areas of greatest point density appear to be around the City of Bellingham. The SANET Kernel Density Estimation confirmed this. To run the network kernel density estimation, we selected the network of state and local roads. Disconnected sections would be excluded from the analysis. For our point layer, we selected the wildlife incidents vector layer. Using the equation suggested by the SANET team, [Band size] = 10 x [Cell size] we selected a band size of 1000 and a cell size of 100. A cell size of 100 was large enough to aggregate individual points, giving us a representation of overall point density along the network. We classified the resulting output vector using Natural Breaks (Jenks) with five classes (Figure 4). This result is shown as line segments, symbolized by weight and color. The fifth class within the network kernel density output, symbolized as a thick red line represents segments of the road network with the highest wildlife incident density.

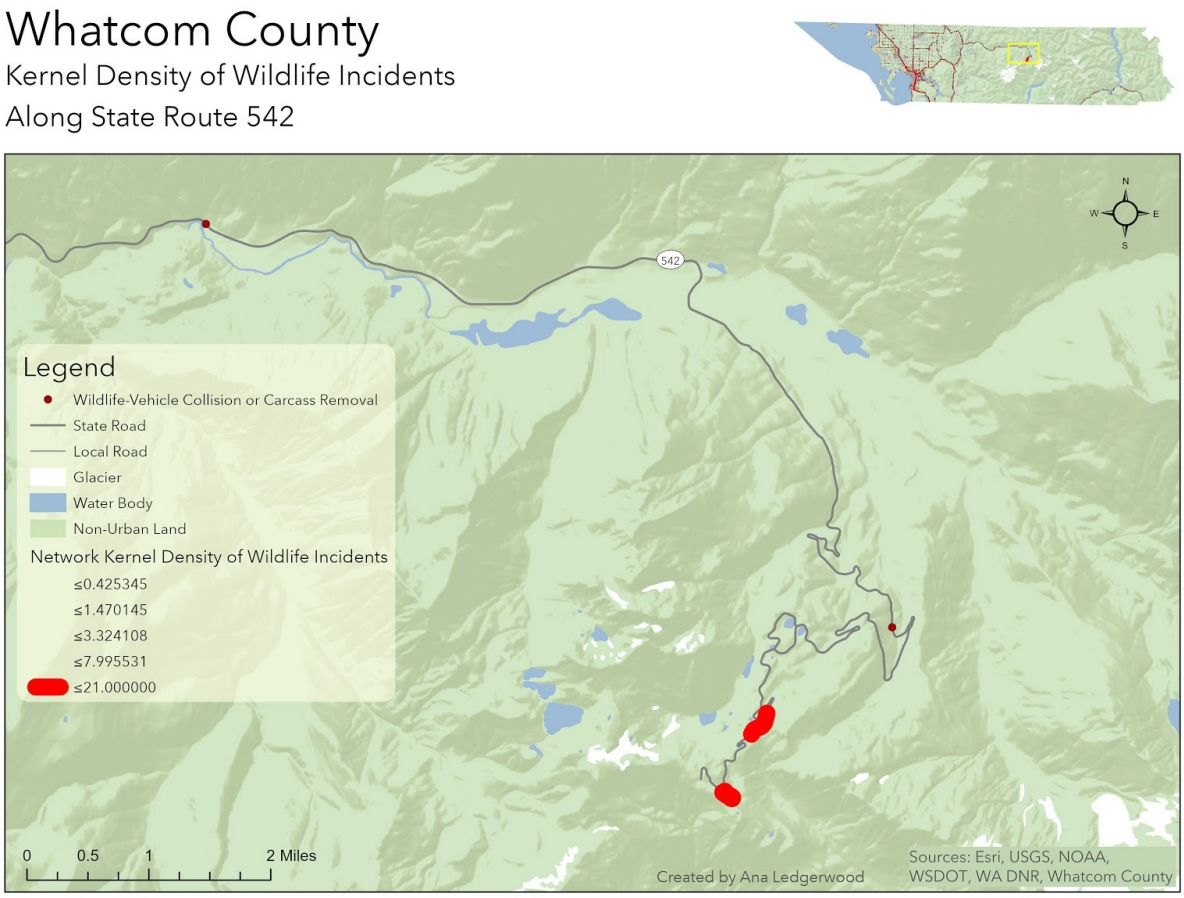
Figure 4. Whatcom County: Kernel Density of Wildlife Incidents Along State and Local Roads

(Continued on page 29)

(Wildlife Crossing-DTA Winner; continued from page 28)

This kernel density estimation confirmed that the areas of greatest wildlife incident density are within or close to the City of Bellingham, with two exceptions. Four areas along Interstate 5 have the highest point density, according to the SANET algorithm. Two areas on State Route 9 near Mount Baker were also represented as having the highest wildlife incident density. A comparison of wildlife incident points against these two areas of high point density, however reveals that the high density areas do not correspond to a large number of wildlife incident points in those areas. In fact, only two wildlife incidents were recorded along that section of State Route 542, and neither incident point is near to the high point density areas produced by the SANET algorithm (Figure 5).

Figure 5. Whatcom County: Kernel Density of Wildlife Incidents Along State Route 542



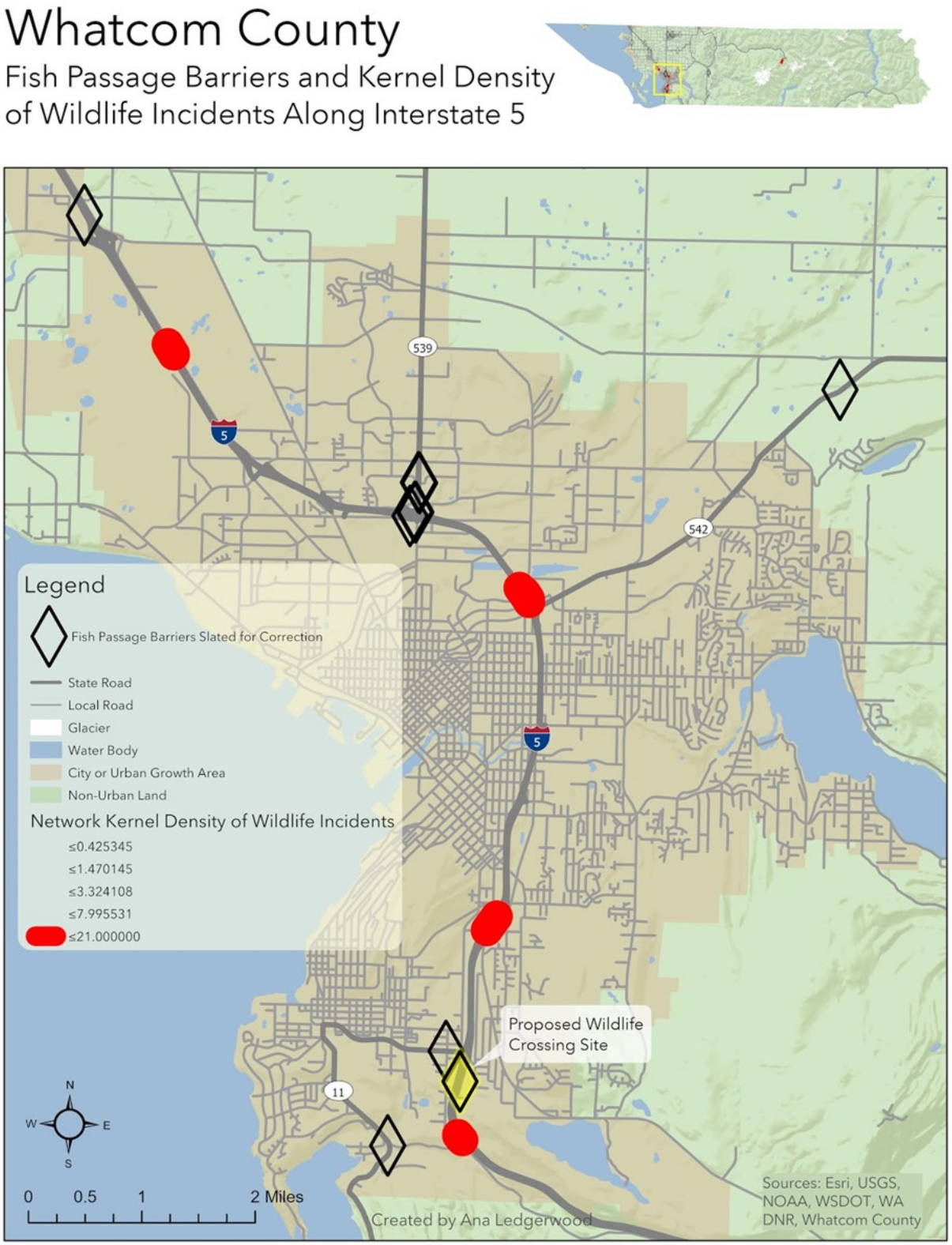
These two areas of highest wildlife incident point density appear to be errors in the SANET Kernel Density Estimation output. For this reason, we did not include them in our site selection for potential wildlife crossings. Since the SANET Kernel Density Estimation tool is designed to calculate point density along a connected linear network, we hypothesize that the errors shown in Figure 5 are due to this section of State Route 542 being a dead end road.

A closer view of wildlife incident density along roads in the City of Bellingham reveals four distinct areas of highest wildlife incident density (Figure 6). In our discussions with officials from Whatcom County and WSDOT we learned that siting a wildlife crossing at the location of a fish passage barrier that is slated for correction increased the likelihood that such a wildlife crossing would actually be built. By "piggybacking" a wildlife crossing onto a fish passage barrier modification costs could be greatly reduced. We therefore selected the fish passage barrier correction location (symbolized in yellow) closest to an area of highest wildlife incident density. This is our proposed site for a wildlife crossing in the City of Bellingham.

(Continued on page 30)

(Wildlife Crossing-DTA Winner; continued from page 29)

Figure 6. Whatcom County: Fish Passage Barriers and Kernel Density of Wildlife Incidents Along Interstate 5

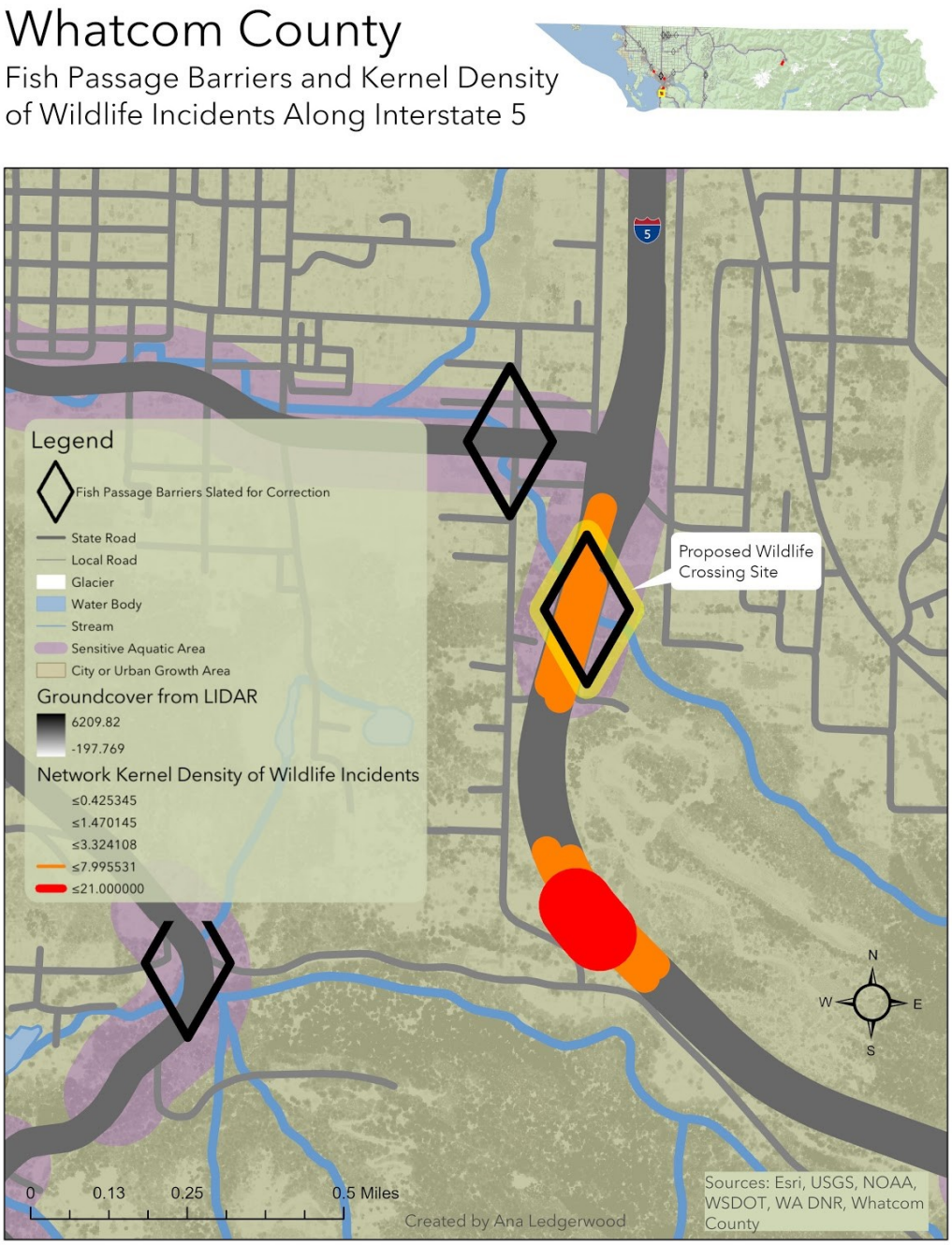


(Continued on page 31)

(Wildlife Crossing-DTA Winner; continued from page 30)

Figure 7, which shows this area at a larger scale includes both the areas of highest and second-highest wildlife incident density. Not only is our selected fish passage barrier location close to an area of highest wildlife incident density, it is directly underneath an area of high (second-highest) wildlife incident density (symbolized in orange).

Figure 7. Whatcom County: Fish Passage Barriers and Kernel Density of Wildlife Incidents Along Interstate 5



We have also created a series of maps that overlay the results of the SANET Kernel Density Estimation on top of existing vector data,

(Continued on page 32)

(Wildlife Crossing-DTA Winner; continued from page 31)

for the purposes of comparison. Figure 8 displays the density of wildlife incidents on top of traffic volume data (annual average daily traffic, or AADT) from WSDOT, symbolized in five classes from light beige to dark brown using Natural Breaks (Jenks). The four areas of highest wildlife incident density occur on sections of Interstate 5 that have the highest and second-highest AADT.

Figure 8. Whatcom County: Traffic Volume and Kernel Density of Wildlife Incidents Along Interstate 5

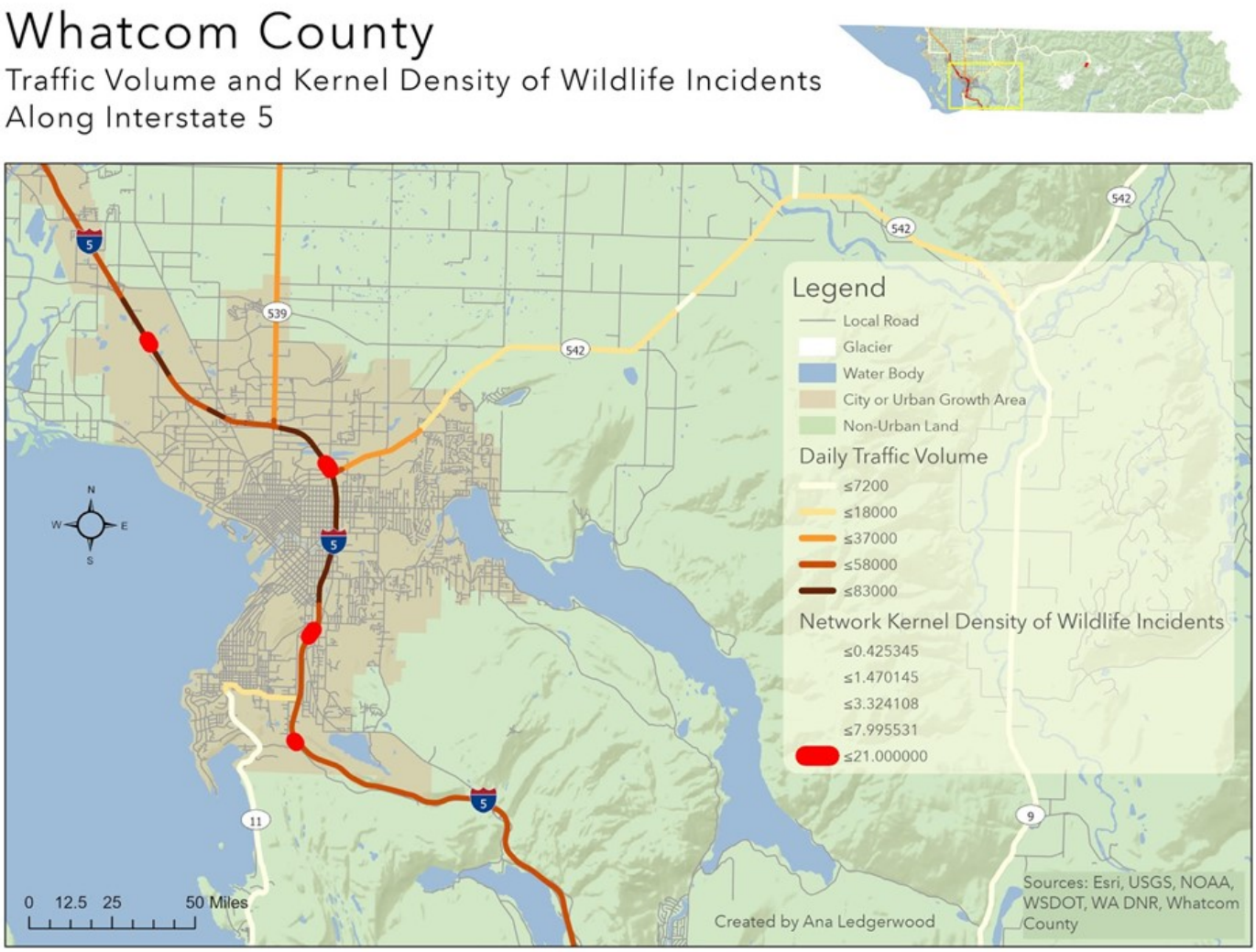


Figure 9 shows the results of the SANET Kernel Density Estimation on top of speed limit data from WSDOT. Speed limit is symbolized as a dark blue to red color ramp, with red indicating sections of road with the highest speed limit (61 to 70 miles per hour). Three of the four areas of highest wildlife incident density occur on sections of Interstate 5 that have a speed limit of 51 to 60 miles per hour.

(Continued on page 33)

(Wildlife Crossing-DTA Winner; continued from page 32)

The fourth area of highest wildlife incident density, the northernmost area occurs at a point of speed limit change.

Figure 9. Whatcom County: Speed Limit and Kernel Density of Wildlife Incidents Along Interstate 5

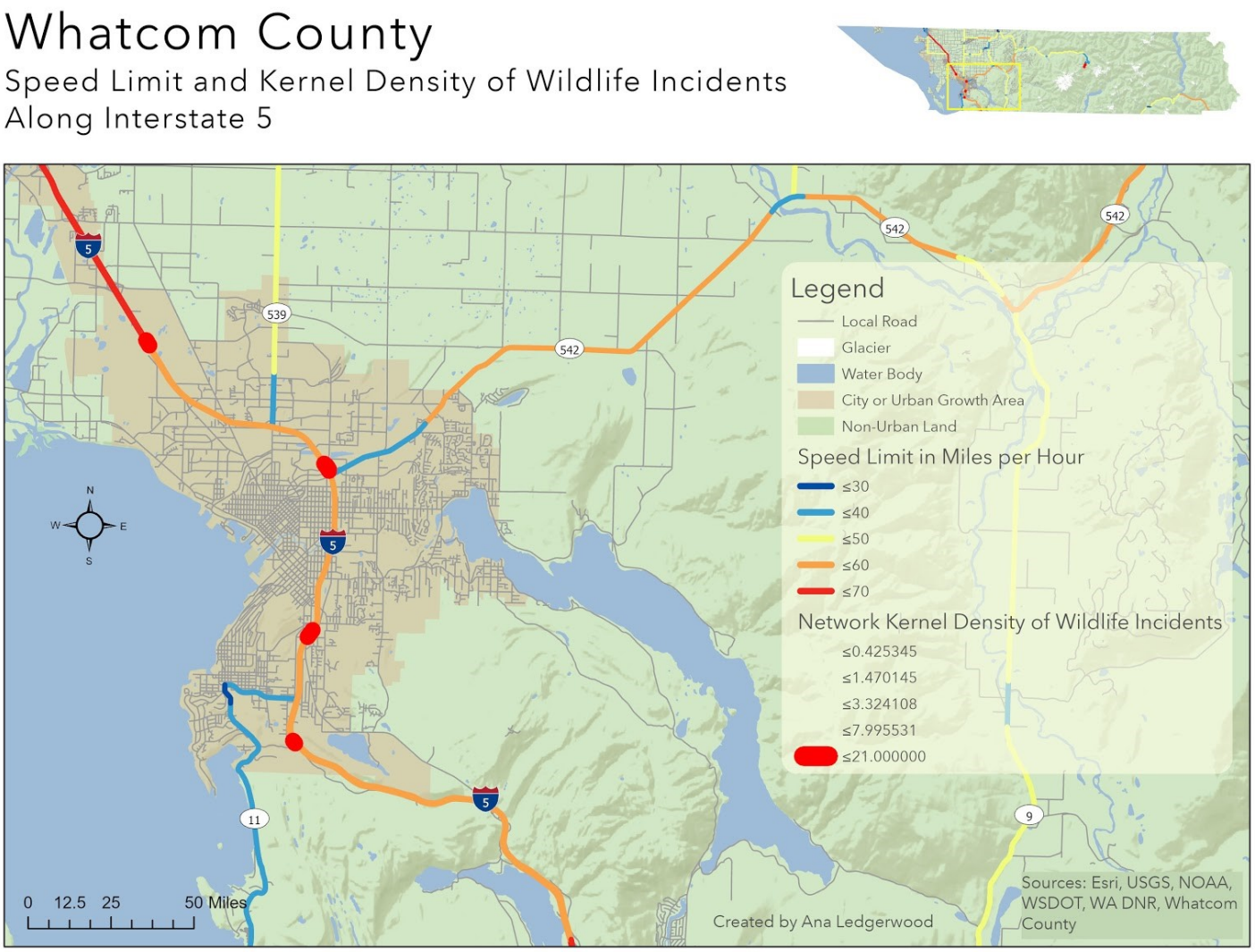


Figure 10 shows the results of the SANET Kernel Density Estimation on top of data from WSDOT that ranks sections of state roads according to their safety for animals. This ranking, which comes from the WSDOT Habitat Connectivity Investment Priorities Project uses WVC, traffic and habitat data to inform its ranking. A ranking of "None" means the section of road is relatively safe for animals. A ranking of "High" means the section of road is highly dangerous for animals.

(Continued on page 34)

(Wildlife Crossing-DTA Winner; continued from page 33)

Figure 10. Whatcom County: Safety Ranking and Kernel Density of Wildlife Incidents Along Interstate 5

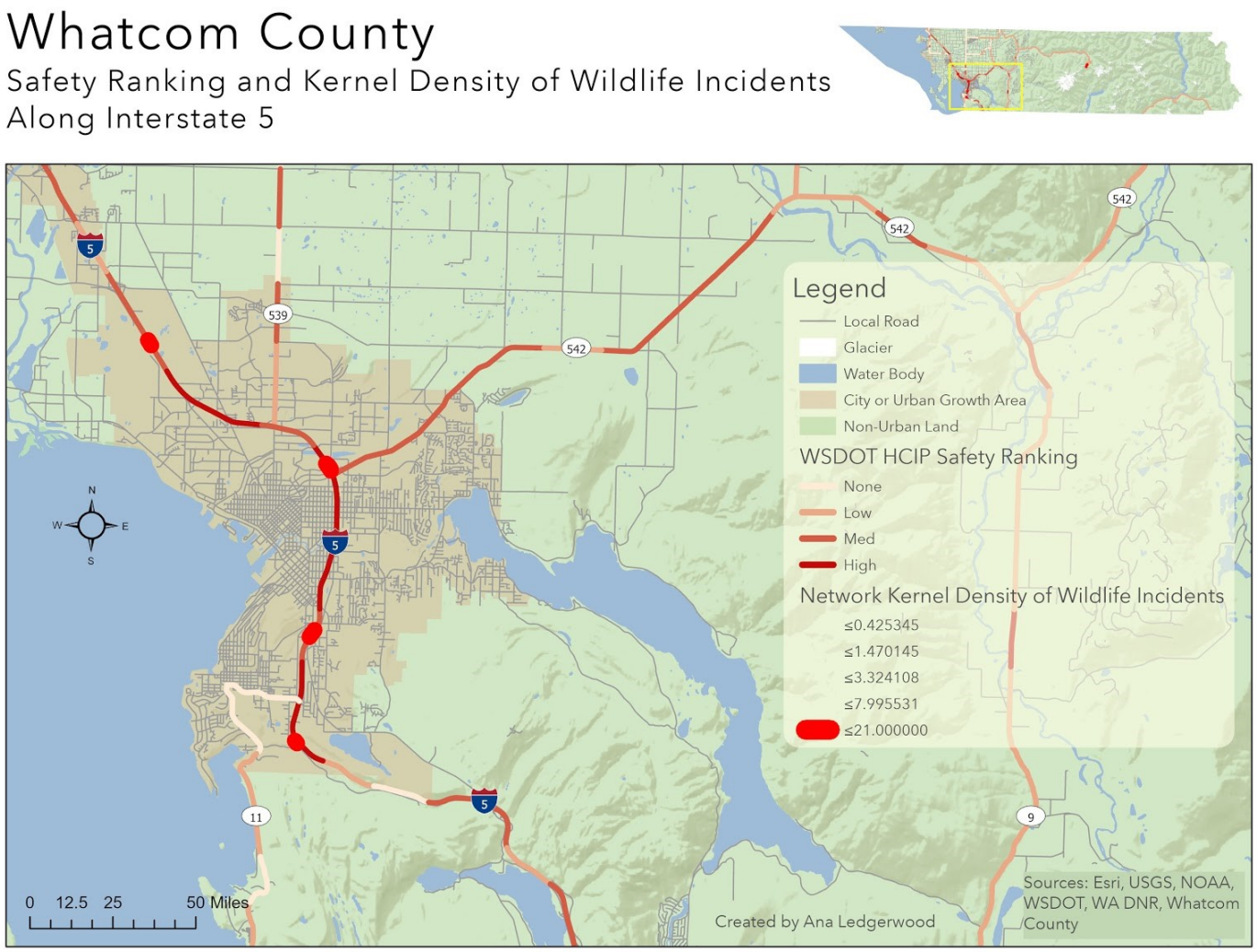


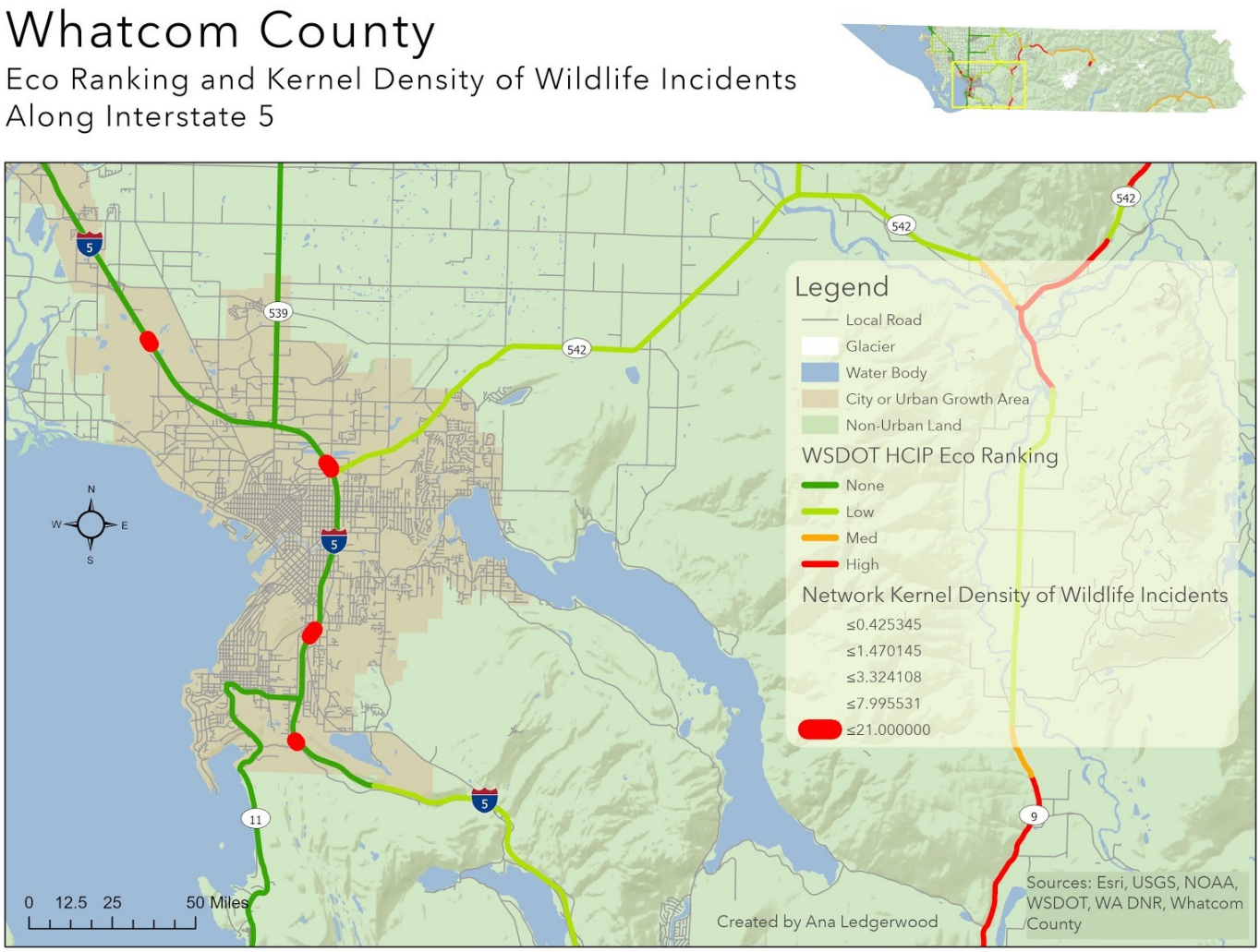
Figure 11 shows the results of the SANET Kernel Density Estimation on top of data from WSDOT that ranks sections of state roads according to their ecological vulnerability. This ranking, which also comes from the WSDOT Habitat Connectivity Investment Priorities Project, uses WVC and habitat data, focusing on threatened species such as elk. A ranking of "None" means the section of road was

(Continued on page 35)

(Wildlife Crossing-DTA Winner; continued from page 34)

judged not to be ecologically vulnerable. A ranking of "High" means the section of road has high ecological vulnerability. Figures 8 through 11 conclude our examination of all-species wildlife incident density.

Figure 11. Whatcom County: Eco Ranking and Kernel Density of Wildlife Incidents Along Interstate 5



We wanted to provide views of both overall wildlife incident density (Figures 3 through 11) and of incident density of a threatened and ecologically vulnerable species. For this reason, we also ran an analysis of elk incidents (WVCs and carcass removals) in Whatcom County using the same SANET Kernel Density Estimation tool. The same band size and cell size parameters were used in this second analysis. Figure 12 displays the elk incidents recorded by state and local agencies. The area in green to the east of State Route 9 is an elk winter habitat area. This elk habitat data was collected by the Priority Habitats and Species Program (PHS) run by the WDFW. This dataset was generously provided to us by WDFW for use in our analysis.

(Continued on page 36)

(Wildlife Crossing-DTA Winner; continued from page 35)

Figure 12. Whatcom County: Elk-Vehicle Collisions, Elk Carcass Removals, and Elk Habitat Areas

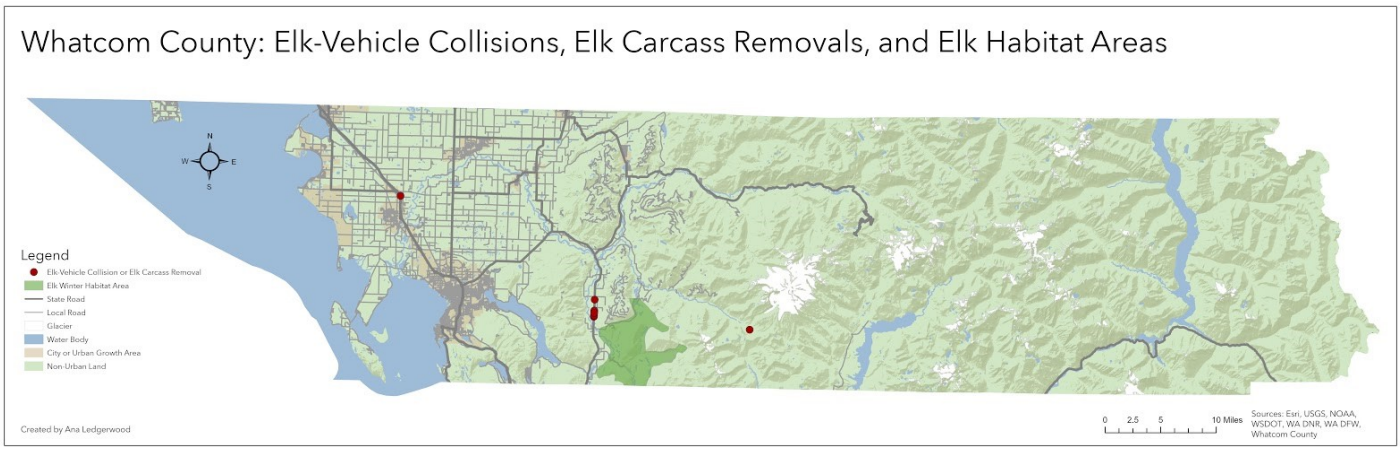


Figure 13 displays the results of the SANET Kernel Density Estimation, using a band size of 1000 and a cell size of 100. Only one area of highest elk incident density emerged from this analysis, which is symbolized as a thick red line. This result therefore focused our wildlife crossing selection to this section of State Route 9.

Figure 13. Whatcom County: Kernel Density of Elk Incidents Along State and Local Roads

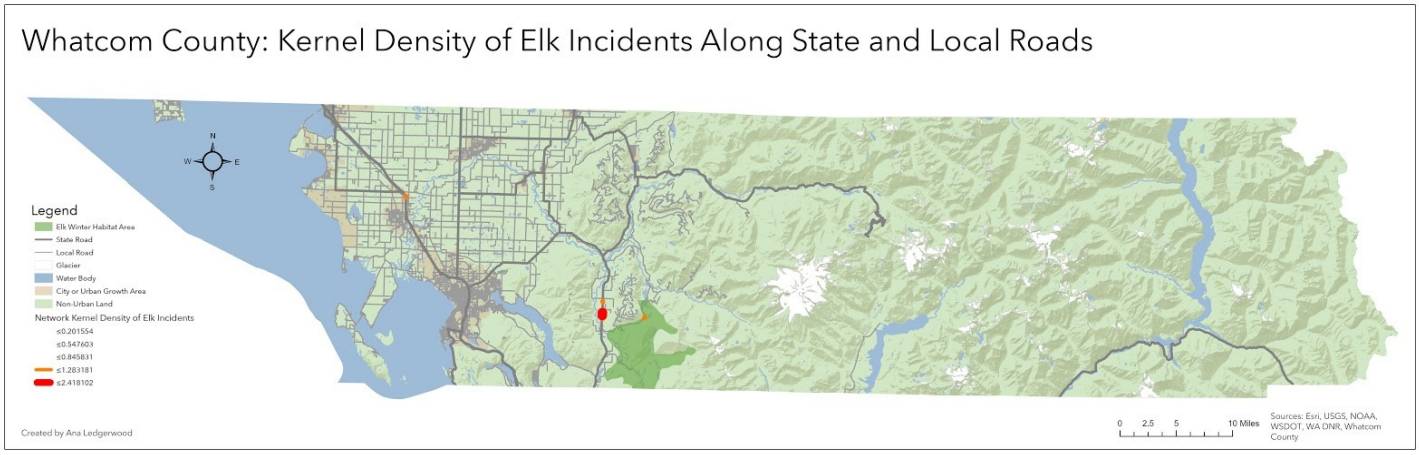
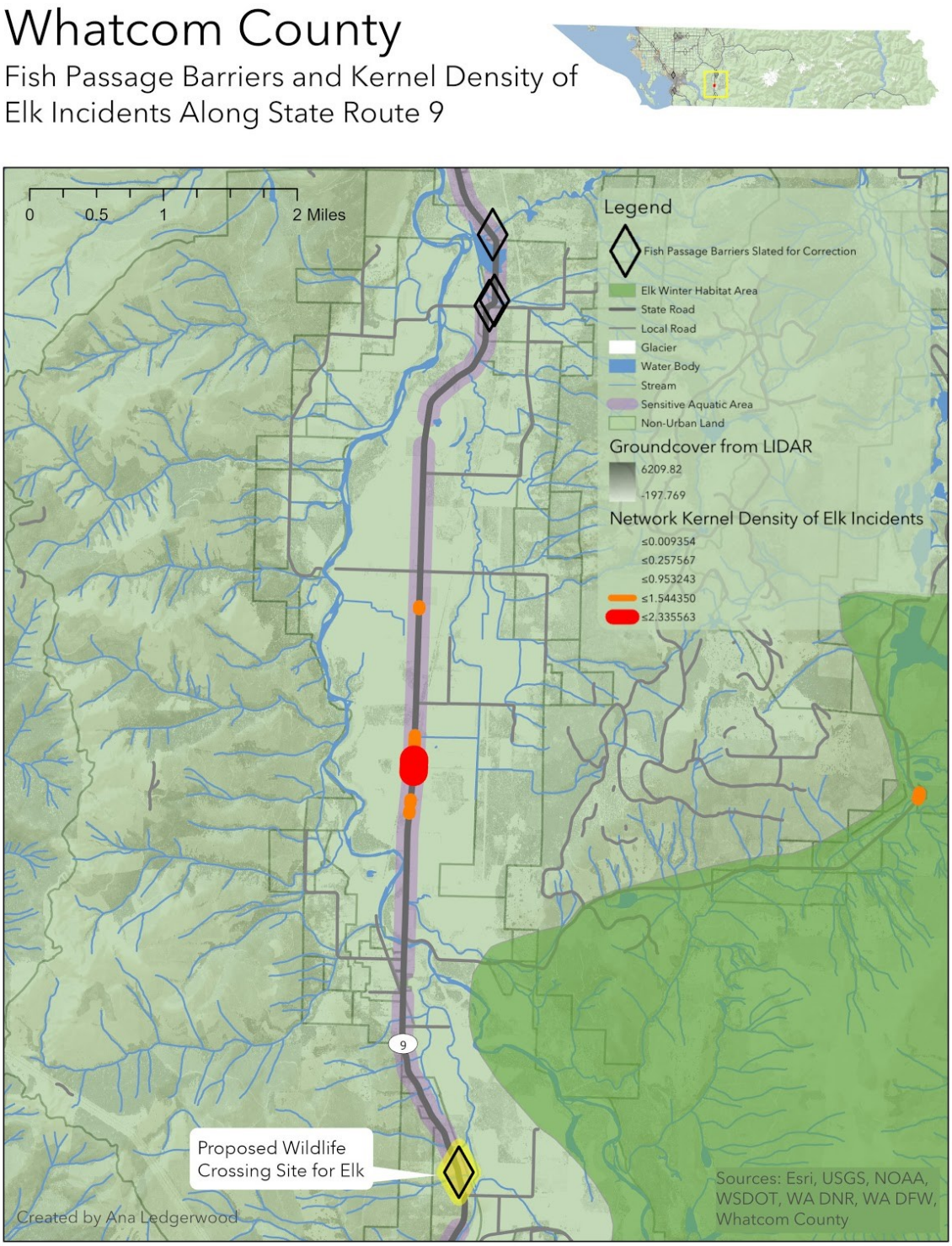


Figure 14 shows this section of State Route 9 at a larger scale, with nearby fish passage barriers slated for correction symbolized as hollow diamonds and the elk winter habitat area again symbolized in green for reference. We have chosen the fish passage barrier to the south of the area of highest elk incident density as the location of our second proposed wildlife crossing. We chose this fish passage barrier location for its proximity to the area of highest elk incident density and its proximity to the elk winter habitat area.

(Continued on page 37)

(Wildlife Crossing-DTA Winner; continued from page 36)

Figure 14. Whatcom County: Fish Passage Barriers and Kernel Density of Elk Incidents Along State Route 9



(Continued on page 38)

(Wildlife Crossing-DTA Winner; continued from page 37)

We have also created a similar series of comparison maps for the elk incident density analysis as we did for our all-species wildlife incident density analysis (Figures 3 through 11). The four maps include a comparison of the elk incident density data against annual average daily traffic volume (Figure 15), against speed limit (Figure 16), against the WSDOT HCIP safety ranking (Figure 17), and against the WSDOT HCIP ecological ranking (Figure 18). We used the same symbology as in Figures 8 through 11 for continuity.

Figure 15. Whatcom County: Traffic Volume and Kernel Density of Elk Incidents Along State Route 9

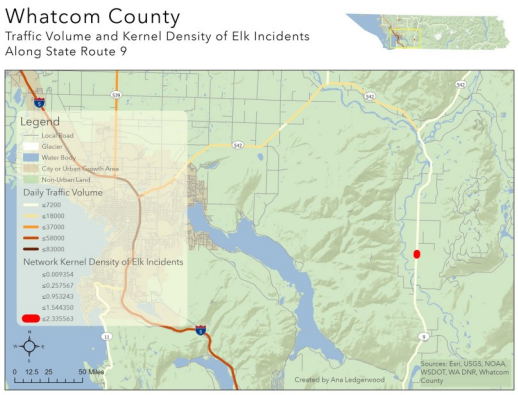


Figure 16. Whatcom County: Speed Limit and Kernel Density of Elk Incidents Along State Route 9

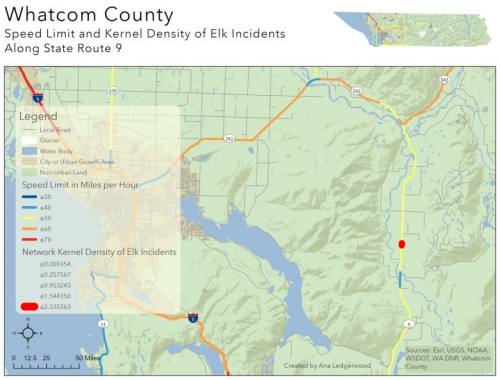
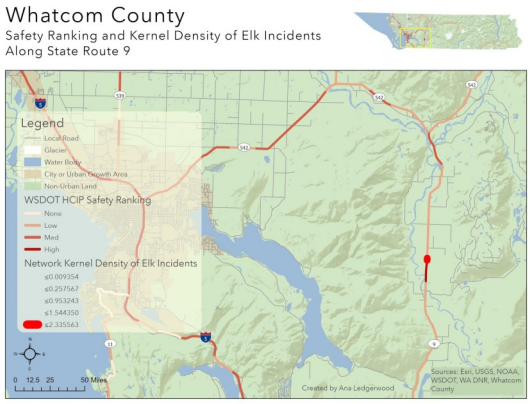


Figure 17. Whatcom County: Safety Ranking and Kernel Density of Elk Incidents Along State Route 9



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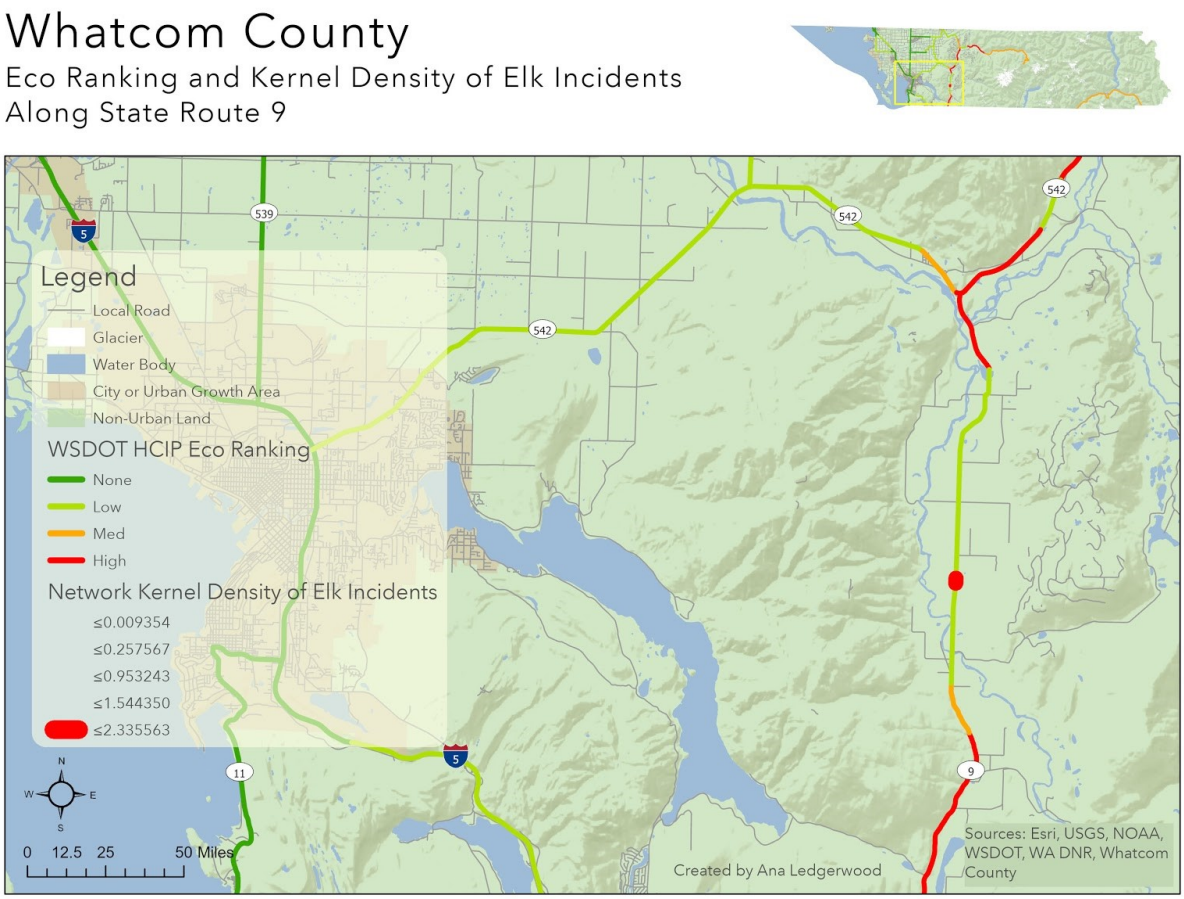
(Wildlife Crossing-DTA Winner; continued from page 38)

Figure 18. Eco Ranking Kernel Density of Elk Incidents Along State Route 9



About the team

We are all students who have recently graduated from The University of Washington's Professional Continuing Education Geographic Information System Program. We came up with the idea for this project during our first month of the program and sought out sponsors within Whatcom County and WSDOT to help us get usable data. These two parties were extremely helpful in making this project a reality as well as the SANET team.

Source Links:

1. ARC Solutions. (2017). Highway crossing structures for wildlife: Benefits of a national commitment to increase driver and animal safety. ARC Special Publication No. 1(1), pp. 20. Retrieved from: arc-solutions.org/arc-special-publications

USGS DEM Data:

http://gis.ess.washington.edu/data/raster/tenmeter/byquad/index.html

DNR County Boundaries

http://geo.wa.gov/datasets/wadnr::wa-county-boundaries

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Meets the 2nd Wednesday of each month.

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Cowlitz-Wahkiakum GIS User Group

Meets the first Wednesday of each month at 3:00 pm at the Cowlitz County Administration Annex Building, CWCOG meeting room, 207 North 4th Ave, Kelso WA (*unless other location is announced).*

Contact Ken Pearrow

King County GIS User Group

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