

article 3: Exploring your watershed with online tools

-- Two 10-minute tours

No doubt, the best way to get to know your watershed is by spending time outdoors visiting different parts of it. Every area you visit provides another challenge to figure out: What's happening here? What happened here before? What changes can be seen, and what might they mean in 10 years, in 100? What do we want it to be like in the future? (We do have some say in the matter, as is pointed out throughout this landowner's guide.) In this guide, we encourage asking slightly more specific questions: What's happening here that affects salmon? What's happening that's good for them? What's happening that harms them? What CAN we do to make things better for salmon? What are we **WILLING** to do? It makes sense to ask these questions if we want salmon to keep returning to peninsula watersheds; and chances are, if a watershed is in good shape for salmon, it will also be in good shape for us and for most of the plants and animals that make the watershed their home.

But even if we can't get outdoors to places we'd like to see, we can have fun preparing for future visits by exploring watersheds using some remarkable online tools. In this introductory article, we introduce two of these: (1) the Kenai Peninsula Borough's Interactive Parcel Viewer and (2) the Kenai Watershed Forum's atlas. We provide step-by-step instructions for using the first and then introduce the second enough to get you started. We suggest you also check out google earth (<http://www.google.com/earth/index.htm><http://www.google.com/earth/index.htm>), or if you don't want to download the google earth application, try google maps instead (go to <http://maps.google.com/> and click the *Satellite* button in the upper right of your screen once you get to where you want to explore). Also, you can literally fly along much of the Alaskan coast in photographs using Alaska Shorezone Mapper (<http://conserveonline.org/workspaces/shorezone/documents/fly-the-coastline/view.html>). The **map below** shows areas covered by shorezone photography. Whichever tools you try, chances are the more you explore, the more you'll discover there is to explore.

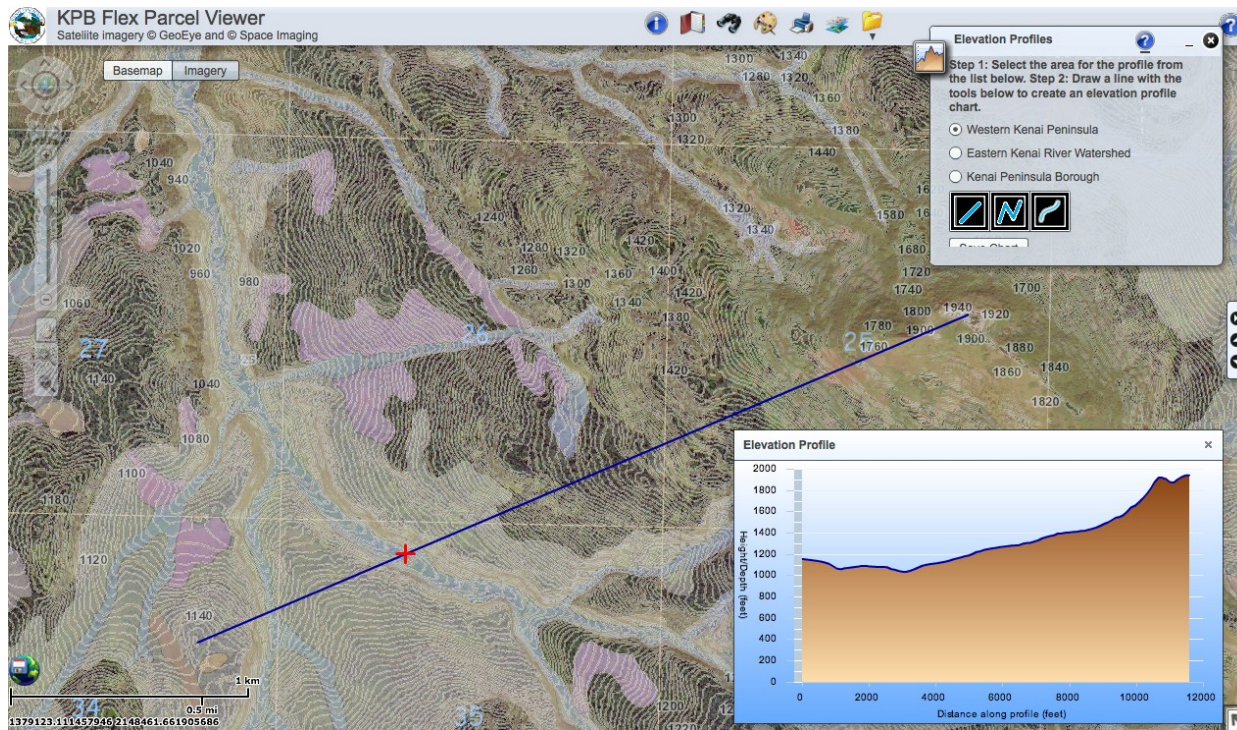
All the online tools so far mentioned illustrate a geographic information systems (GIS). A GIS is typically used to store and manage large amounts of “geospatial” information—for example, data about locations of natural features like soils, stream channels or wetlands, or of structural features like roads or buildings. In addition, a GIS usually includes many kinds of “attribute” information about the mapped features, such as the physical properties of mapped soils (soil texture, depth to water table, etc.) or the ownership and acreage of mapped parcels.



1. The Kenai Peninsula Borough's Interactive Parcel Viewer (IPV)

The KPB maintains an excellent geographic information system (GIS), which can be accessed by anybody with a computer and an internet connection. The borough has continued to improve its GIS since first installing it in the late 1980s. The main public access to the borough's GIS is through the “Interactive Parcel Viewer” (IPV) which is reached through two different websites, each with somewhat different tools. The data available through these two websites is the focus of the first section of this introductory article. The borough also provides maps and/or links related to other GIS data, including:

- Printable maps in pdf format: <http://www2.borough.kenai.ak.us/GISDept/Maps.html>; printable maps include: Kenai Peninsula Borough (in several formats, including *general*, *imagery*, and *shaded relief*); KPB Assembly districts; Fire and Hospital Service Areas; incorporated cities; thematic maps (such as land use, land ownership, and wetlands); and “Other” maps (which includes trails maps);
- KPB transportation portal: <http://www.kpbgis.org/TransportationPortal/index.html>, which provides information about roads in the borough;
- downloadable GIS files as shapefiles or other formats: <http://www2.borough.kenai.ak.us/GISDept/Downloads.html>;
- the state's Kenai easement atlas: <http://dnr.alaska.gov/mlw/planning/easmtatlas/kenai/>; this link also takes you to other state planning information.



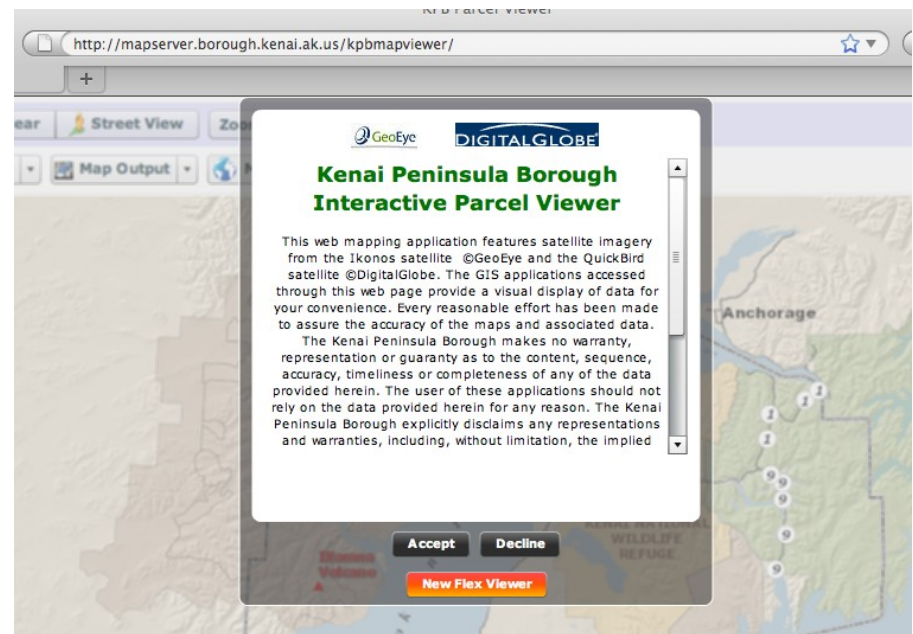
The borough's GIS staff creates, edits, and manages data necessary for operation of borough departments. The GIS supports many kinds of decision making and record keeping, as well as the KPB's Emergency Response system (<http://www2.borough.kenai.ak.us/emergency/>). The borough also provides data to various private, Native, state, and federal entities. Air photography dating back to 1967, and satellite imagery as recent as 2009, can be accessed from the borough's GIS (and the borough will have more recent aerial photography soon). GIS data is also often provided to the public in digital and hardcopy map formats, as noted above.

At left is an image developed using the borough's interactive parcel viewer (IPV); it shows wetlands and elevations on the western slopes of the Caribou Hills. IPV tools used to make this map are discussed below.

As explained on the Kenai Peninsula Borough's GIS website (<http://www2.borough.kenai.ak.us/GISDept/>), the Interactive Parcel Viewer (IPV) provides public, online access to the borough's GIS. It allows anyone with a computer and an internet link to find and look at many kinds of geographic information using a variety of applications, tools, digital maps, and free data. The online “Help” files for the IPV are found at: <http://mapserver.borough.kenai.ak.us/kpbmapviewer/Help/default.htm> (for the “mapserver” version discussed first below) and <http://www2.borough.kenai.ak.us/GISDept/help.html> (for the “flexviewer” version discussed second below).

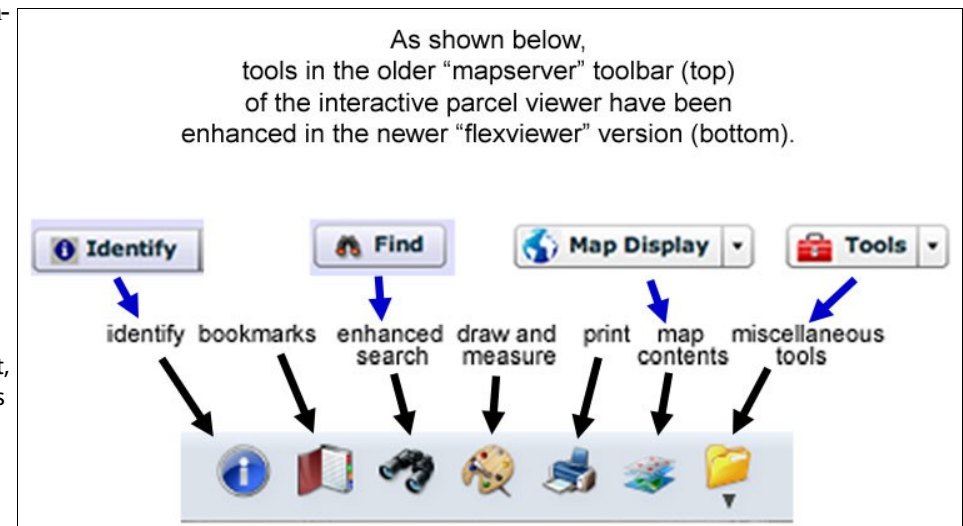
Because a picture is, indeed, worth a thousand words, we'll take a brief journey using pictures from the IPV. Most of our trip takes place in the Stariski Creek watershed, but you could take this kind of journey on almost all non-federal lands on the Peninsula. Since we'll focus on Stariski Creek, we'll see areas used by salmon as they travel the watershed looking for conditions to help them survive and grow, if they're juveniles, or to spawn if adults.

We'll begin at <http://mapserver.borough.kenai.ak.us/kpbmapviewer/>. The window at right will appear. (If it doesn't, you may need to download Adobe Flash. Go to <http://www2.borough.kenai.ak.us/GISDept/ags.html> and download it from the link near the bottom of the page.) To open the parcel viewer, hit *Accept* (near the bottom of the box). Later we'll look at some of the tools found by clicking instead on *New Flex Viewer*, seen in orange under the *Accept* button. (The Flexviewer tool bar is shown below right).



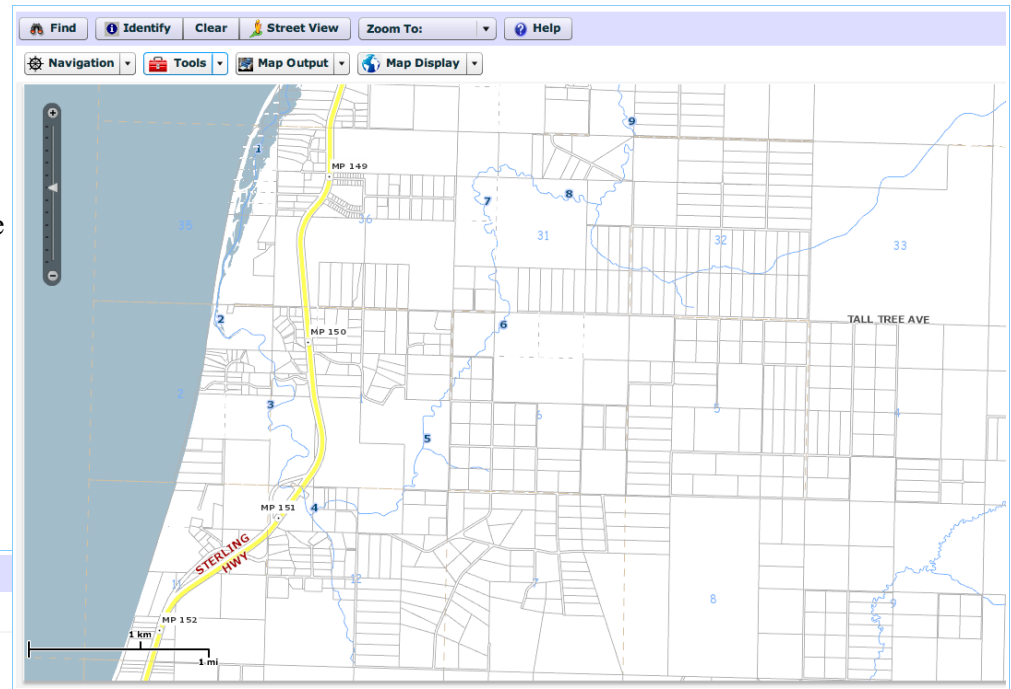
The map that appears when you open the IPV shows the entire Kenai Peninsula Borough. We need to zoom in to at least 1:62,500 to start seeing details. Use the gray slider on the left of the screen to enlarge the map. Move the slider up till it shows 1:62,500. Then click the *Navigation* button near the top left of the screen and click on “Pan.” Pan down the Sterling Highway to MP 150, then zoom in again to a scale of 1:31,250. Now we can see Stariski Creek (shown on next page).

Image on right: If you click “New Flex Viewer” at the screen shown above right, the parcel viewer loads with a different looking set of tools. For one thing, all navigation tools will be with the slider on the left of the screen. Although they look different, Flexviewer buttons generally function like buttons we describe first, or they're enhanced. For example, “**map contents**” lets you view many map layers at once. A slider lets you lighten or darken each layer one-by-one. Also, you can choose “Basemap” or “Imagery” (i.e., aerial photography) as your background. Flexviewer tools are discussed later in this section.



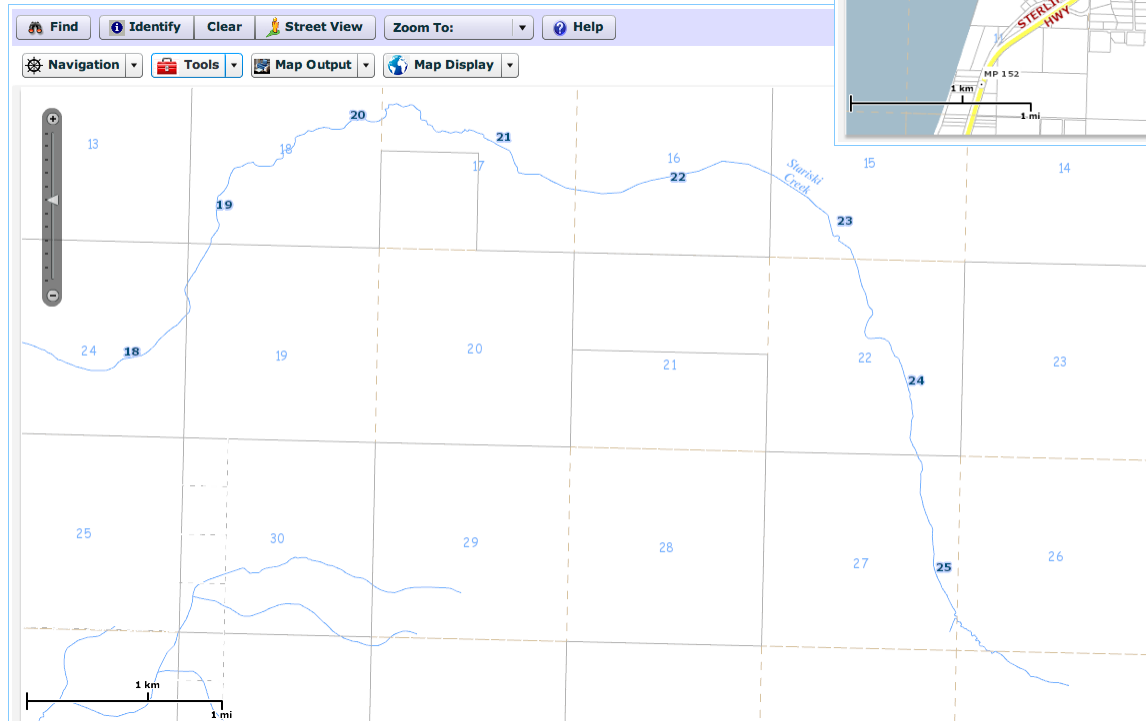
Having moved the slider to a scale of 1:31,250, and using the “Pan” tool found under *Navigation*, we've moved to the the coast where Stariski Creek enters Cook Inlet. Under *Map Display* we've selected “Basemap,” and what we see on the screen is shown **top right**. (Note that IPV screens have been made smaller here, so the **map scale** reported by the slider is no longer accurate.) Stariski Creek is visible as a wiggly blue line that starts at the upper right corner of the screen and ends in a long, narrow estuary at the coast. (See **Estuary** in the watershedipedia for more information and images.)

Using the “Pan” tool under the *Navigation* button, we'll now follow this wavy blue line north and east for about 20 miles, finally turning southeast about 6 miles before the line disappears into streams too small to have been mapped at this scale. There, Stariski Creek **headwaters** on the western slopes of the **Caribou Hills** (see **map below**.)

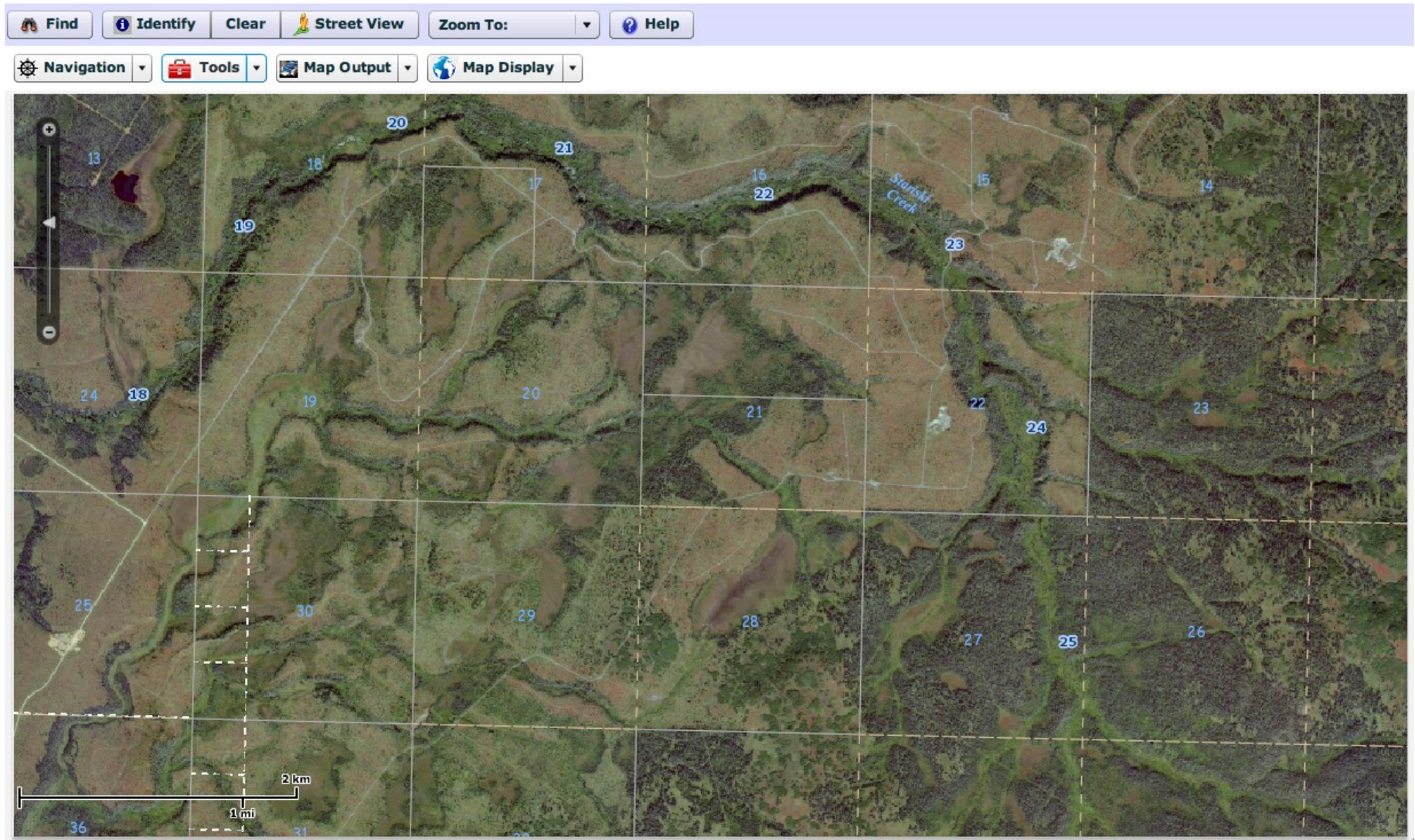


Our journey has quickly taken us almost 26 miles “as the boat floats,” and we now see the IPV **screen seen at left**.

Now we'll zoom in farther to see what we can see. But first, we'll go to the *Map Display* button near the top of the screen. Click the arrowhead on the right side of the button, and choose “Imagery” from the dropdown menu that appears. That will give us the image found on the next page.

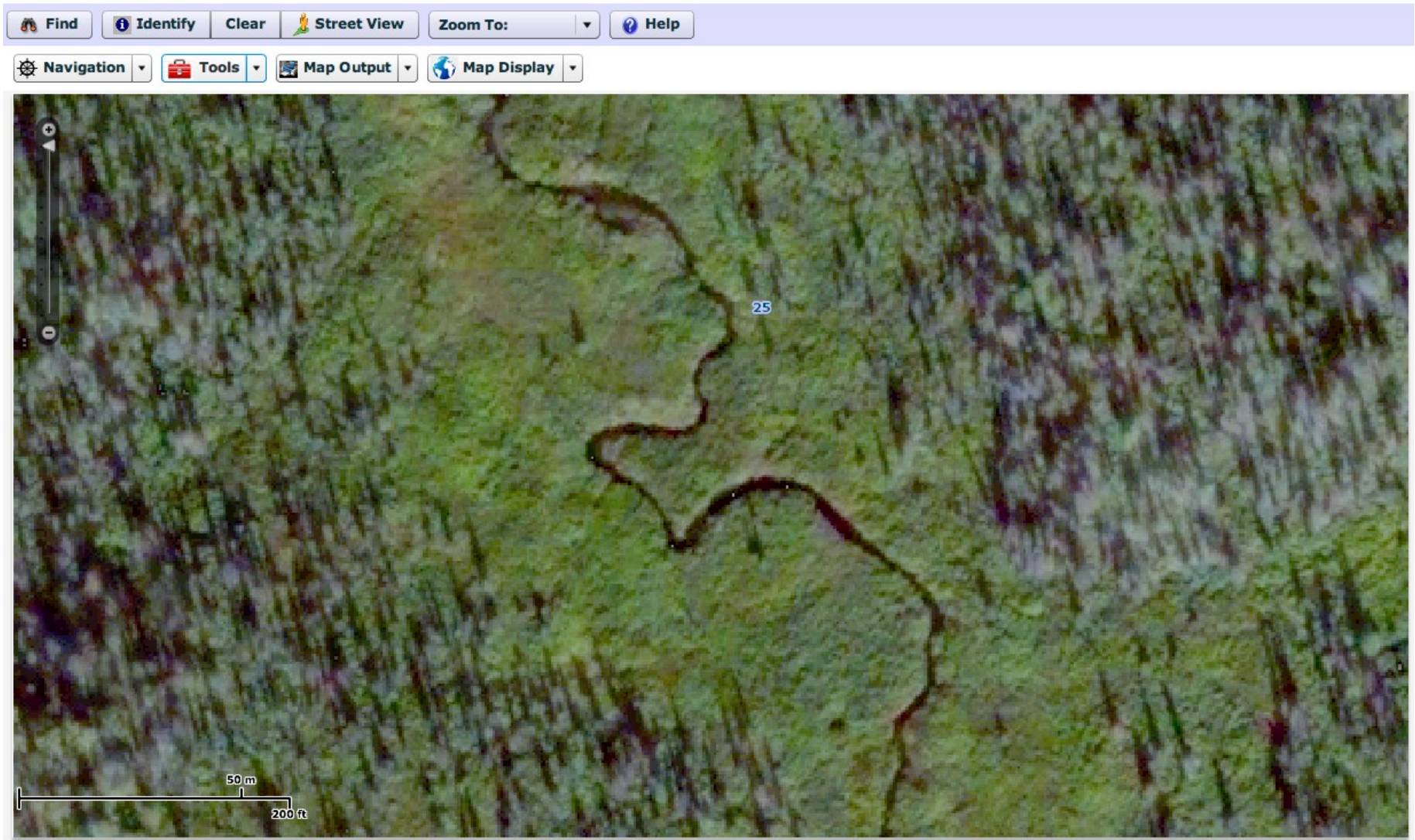


The **aerial image below** shows the end of Stariski Creek's mapped channel as shown at a reported scale of 1:31,250. (We have reduced image size below, which reduces the actual scale—the bar scale on the bottom left of the image remains accurate because it gets shorter as the image gets smaller.) Be careful not to confuse river mile numbers—blue numbers outlined in white—with *section* numbers—blue numbers with no outline. (Section numbers are part of the Public Land Survey System, or PLSS. Each section is 1 mile square (640 acres); 36 sections in a 6-mi-by-6-mi square constitute a particular “Township” and “Range,” see http://nationalatlas.gov/articles/boundaries/a_plss.html for more background.) As we zoom in, section numbers can be used



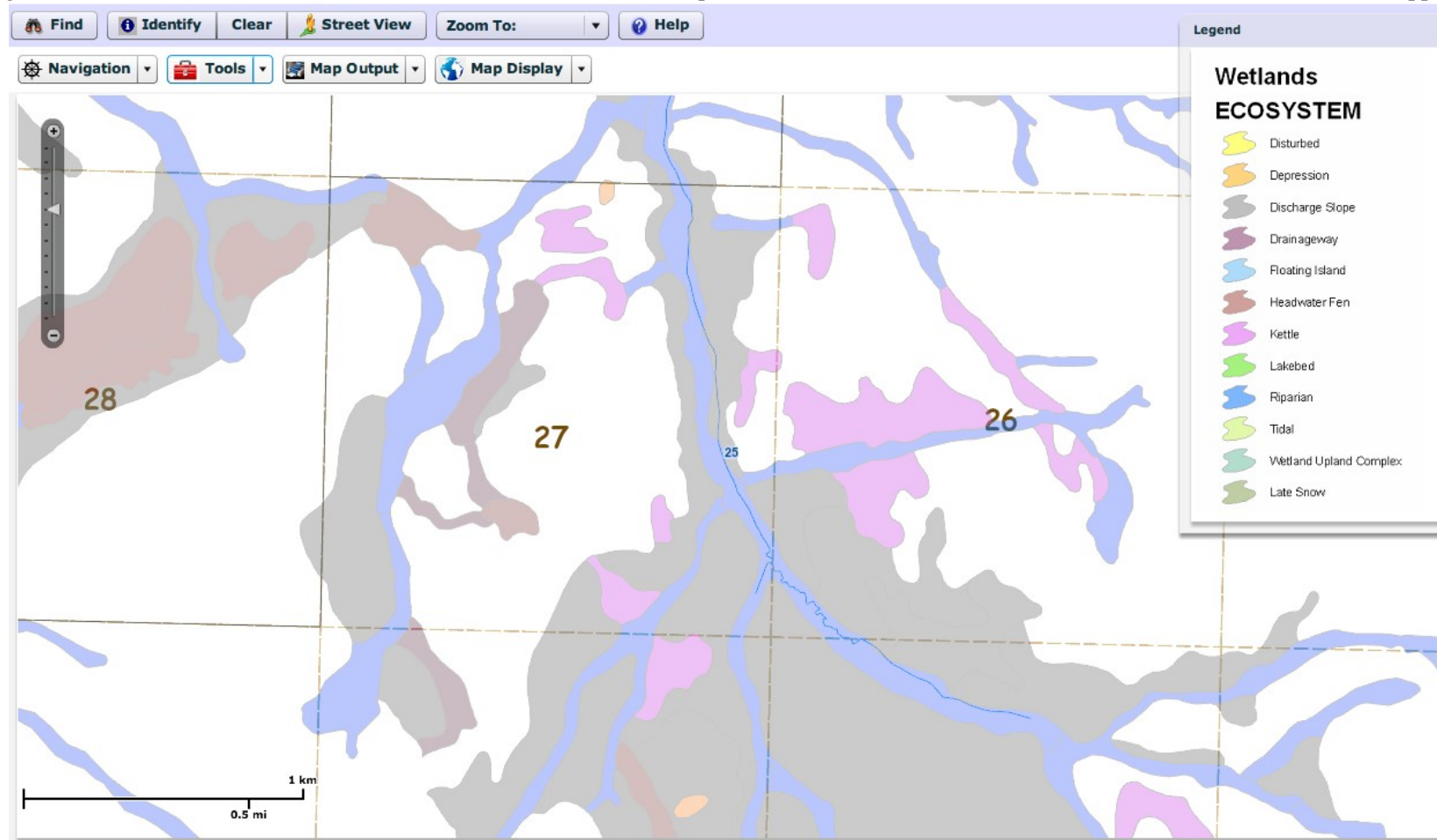
to help keep track of where we are.

In the **image below**, we've moved the slider up to a reported scale of 1:975 (again, since we reduced the image to fit on the page, we've also reduced the scale). We have zoomed in as far as we can with the IPV, and the image has lost a little sharpness. Nonetheless, this is good resolution. We still see river mile 25 in the center of the screen, but now the stream channel is easily visible. In fact, we can follow the channel further up into its **headwaters** when



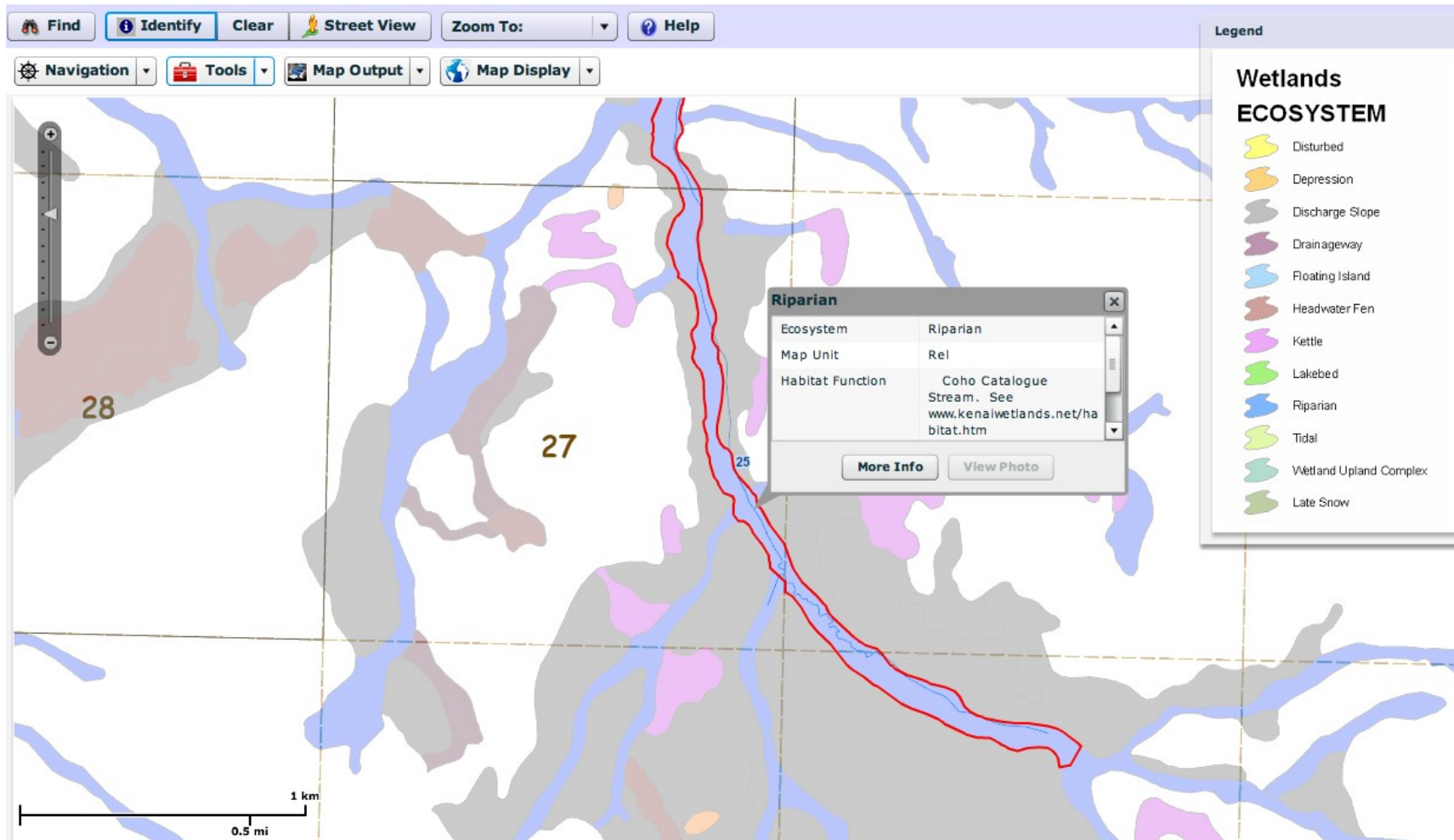
zoomed in this far. We can also see that Stariski Creek **meanders** through a corridor of shrubs (probably willows) that is just over 200 ft wide (as measured with the bar scale at the bottom left of the image). Spruce trees, many of which are dead (gray), border the stream's shrubby **meander belt**. We can also just make out some thin linear features that cross Stariski Creek at several points and continue into the forest. These may very well be game trails, most likely moose. We are flying over the landscape like an eagle. Biologists who regularly use aerial images like this get very good at picking out details and interpreting what they see.

We now zoom back out to a slider scale of 1:15,600 and choose “Wetlands” from the dropdown menu under the *Map Display* button. This gives us the **image below**. We now see wetlands as mapped at a scale of about 1:24,000 (<http://www.kenaiwetlands.net/>). Again we see river mile 25 in the center of the image, as well as section numbers 28, 27, 26, and we know that each square section is a mile on each side. We see that Stariski Creek is mapped as a



Riparian wetland ecosystem (colored in blue), and that its channel flows through both *Discharge slope* (gray) and *Kettle* (dark pink) wetland ecosystems near river mile 25. Because discharge slope wetlands occur where groundwater is often seeping or “daylighting” out onto the surface of the land (i.e., discharging to the surface), we can assume that these discharge slope wetlands are supplying water to Stariski Creek. Areas mapped as *Drainageway* wetland ecosystems (purple) are also visible on the wetland map, as well as two small *Depressions* (orange). (For more background, see *Wetlands* in the watershedipedia.)

To learn more about the Stariski Creek riparian wetland, we click first on the *Identify* button and then twice in the stream channel just upstream of river mile 25. Doing that gives us the **image below**. The box that appears shows that Stariski Creek is an Re1 wetland map unit and that it supports coho



salmon and is listed in the anadromous waters catalog maintained by the Alaska Department of Fish and Game (see <http://www.adfg.alaska.gov/sf/SARR/AWC/>). As discussed under anadromous waters catalog in the watershedipedia, that means this stream channel is subject to a number of regulations designed to protect the salmon in the creek and their habitats. Coho salmon have been documented in this creek, and the anadromous waters catalog identifies what life stages occur here (see *introductory article 1: Salmon species and life cycle*). We can also see that the open box gives us a button to click for *More Info*. Clicking on *More Info* takes us to the **screen below**. This information can also be accessed through the Kenai wetlands website (<http://www.kenaiwetlands.net/>, more specifically <http://www.kenaiwetlands.net/mapunitdescriptions/Rel.htm>) or the Cook Inlet wetlands website (<http://cookinletwetlands.info/>). The screen below shows just some of the information available about this wetland type. Similar detail is provided for every kind of mapped wetland ecosystem on the Kenai Peninsula, and this information can be accessed as we just did, by clicking the *Identify* button and then double clicking in a wetland.


Wetland Classification and Mapping of the Kenai Lowland, Alaska

Map Unit Descriptions

Ecosystem: [Riparian](#)

Map Unit: **Rel**

Extent: 131 wetland polygons; 2326.6 ha; 1.64% of wetland area; 0.79% of wetland polygons.



An Rel stream in the Upper Anchor River Watershed flowing across a former beaver pond breached during the autumn floods of 2002 (polygon 10133).

Wetland Indicators

Type: Stream

Average depth to water table: 46.0 cm; n=23

Organic layer thickness: 44.8 cm; n=26

Average depth to redoximorphic features: 32.6 cm; n=11

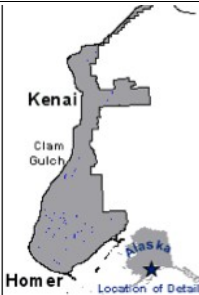
Common Soils: [KILLEY](#), [TLIKAKILA](#), [STARICHKOF](#), [MOOSE RIVER](#), [FORELAND](#), [CHUNILNA](#)

Common Plant communities:

[Bluejoint streamside](#)
[Barclay willow / Bluejoint](#)
[Barclay willow / Bluejoint - Field horsetail](#)
[Barclay willow / Bluejoint / Marsh fivefinger.](#)

NWI: Stream: R2US3,4. Valley wetlands: PSS1/EM1Jg
HGM: Stream: Low Gradient Natural Straight Stream-single thread. Valley wetlands: Lotic Slope/Flat groundwater-dominated Throughflow/Bidirectional-nontidal.

Accuracy assessment: 34 polygons interpreted as Rel on aerial photographs were field checked. 22 remained Rel; 5 were revised to [RB](#); 2 were revised to [Rel](#); 1 each was revised to: [AMT](#), [DISTURB](#), [DW21](#), [Rt](#), and [SS](#).



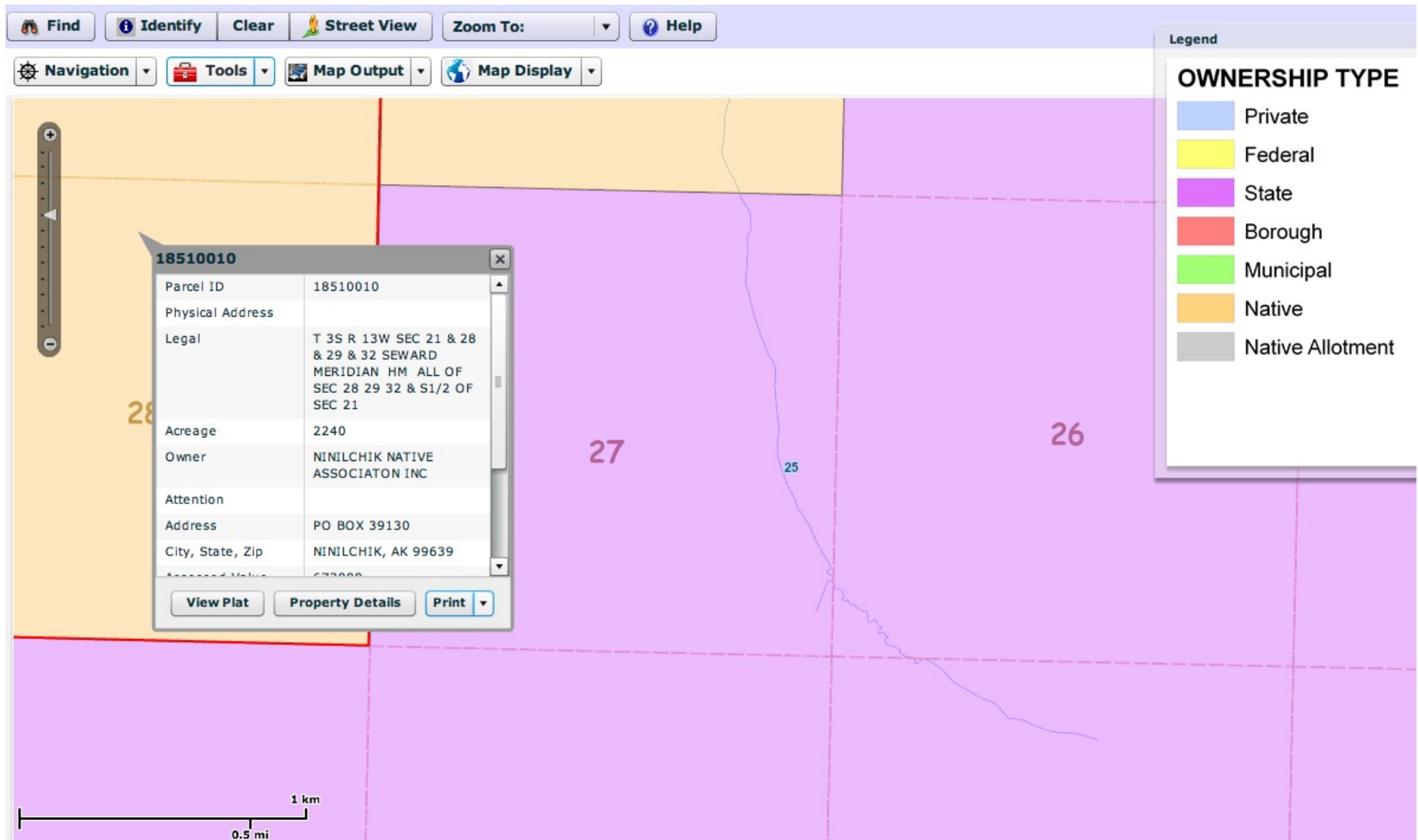
Kenai
Clam Gulch
Homer
Location of Detail

Rel stream reaches are in Rosgen's (1996) E stream category. E streams are slightly entrenched, sluggish, pool-dominated streams with thickly vegetated banks. They occur on surfaces deposited by larger processes. On the Kenai Lowlands, those larger processes occurred when glaciers occupied more of the landscape during the last major advance and then left behind lakebed, drainageway and kettle surfaces.

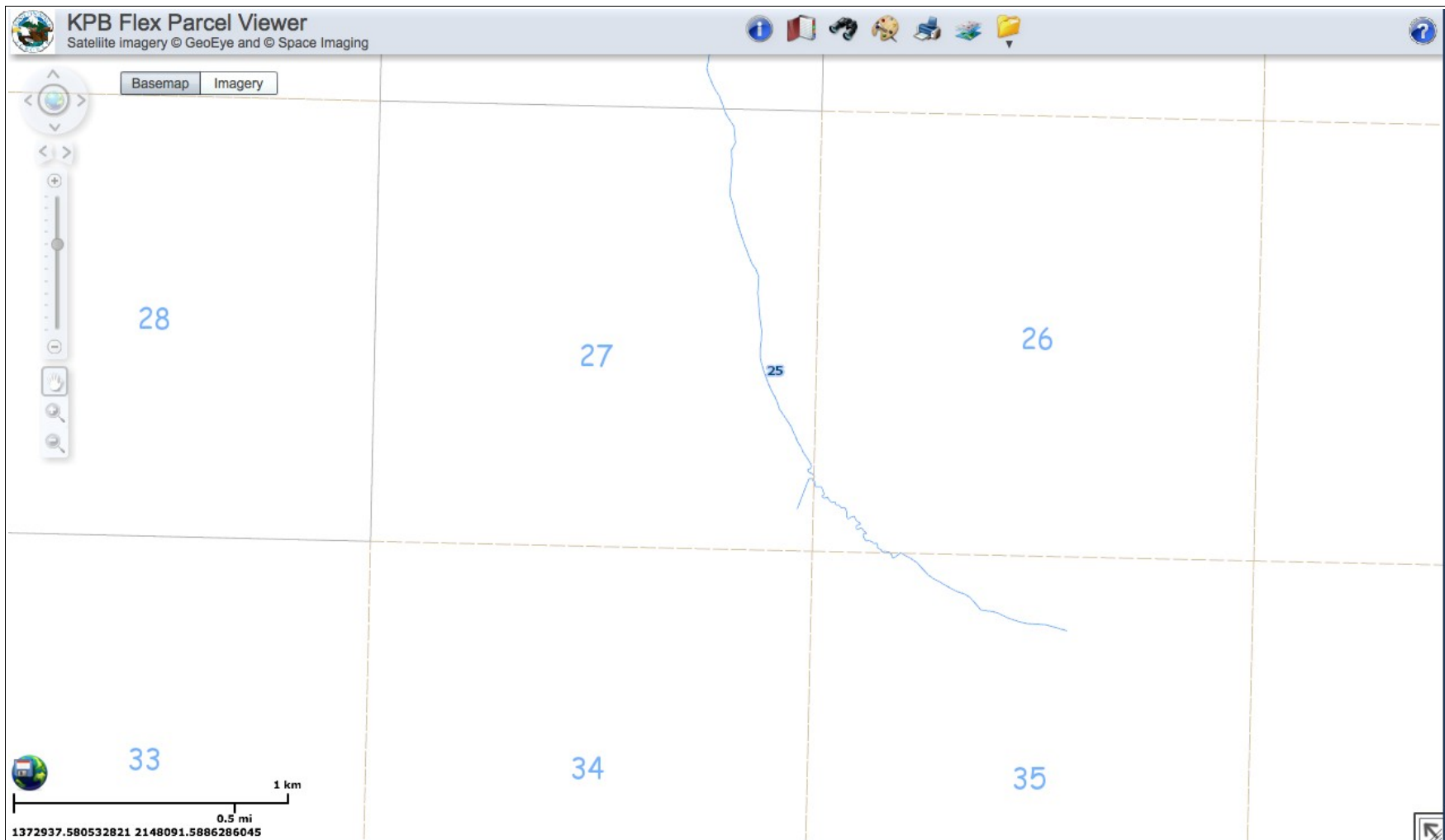
Rel units are E streams with linear channels. Typical Rosgen E streams have high channel sinuosity, but many Kenai Lowland E streams have a sinuosity of less than 1.3 (usually around 1.1). Rel units are common and widespread, they often occur as streams flowing across peatlands on relict glacial lakebeds. Streambed material is typically cobbles (Rosgen's E3), or gravels (E4).

Rel streams frequently have an extensive wetland fringe, as they often occupy relict lakebed surfaces which support large peatland complexes.

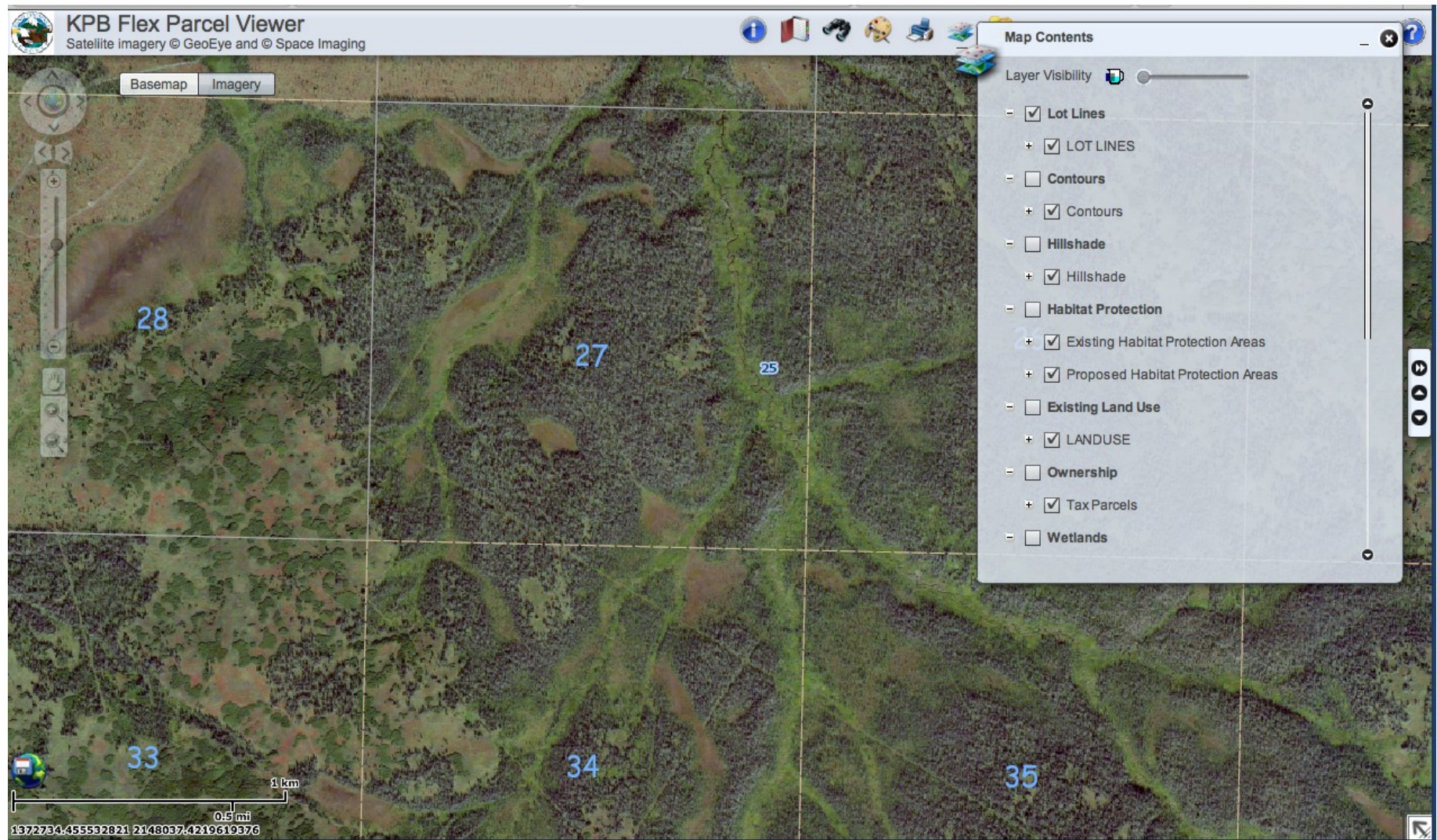
Finally, before switching to the flexviewer version of the IPV to look at slopes, we check landownership in this area. To do this, we just choose “Ownership” in the dropdown menu under the *Map Display* button. A color-coded map of landownership appears, and we see that lands are owned by state or Native landowners. By clicking on the *Identify* button and then twice within the Native land, a box opens showing us that Ninilchik Native Association, Inc. is the landowner, as shown in the **map below**.



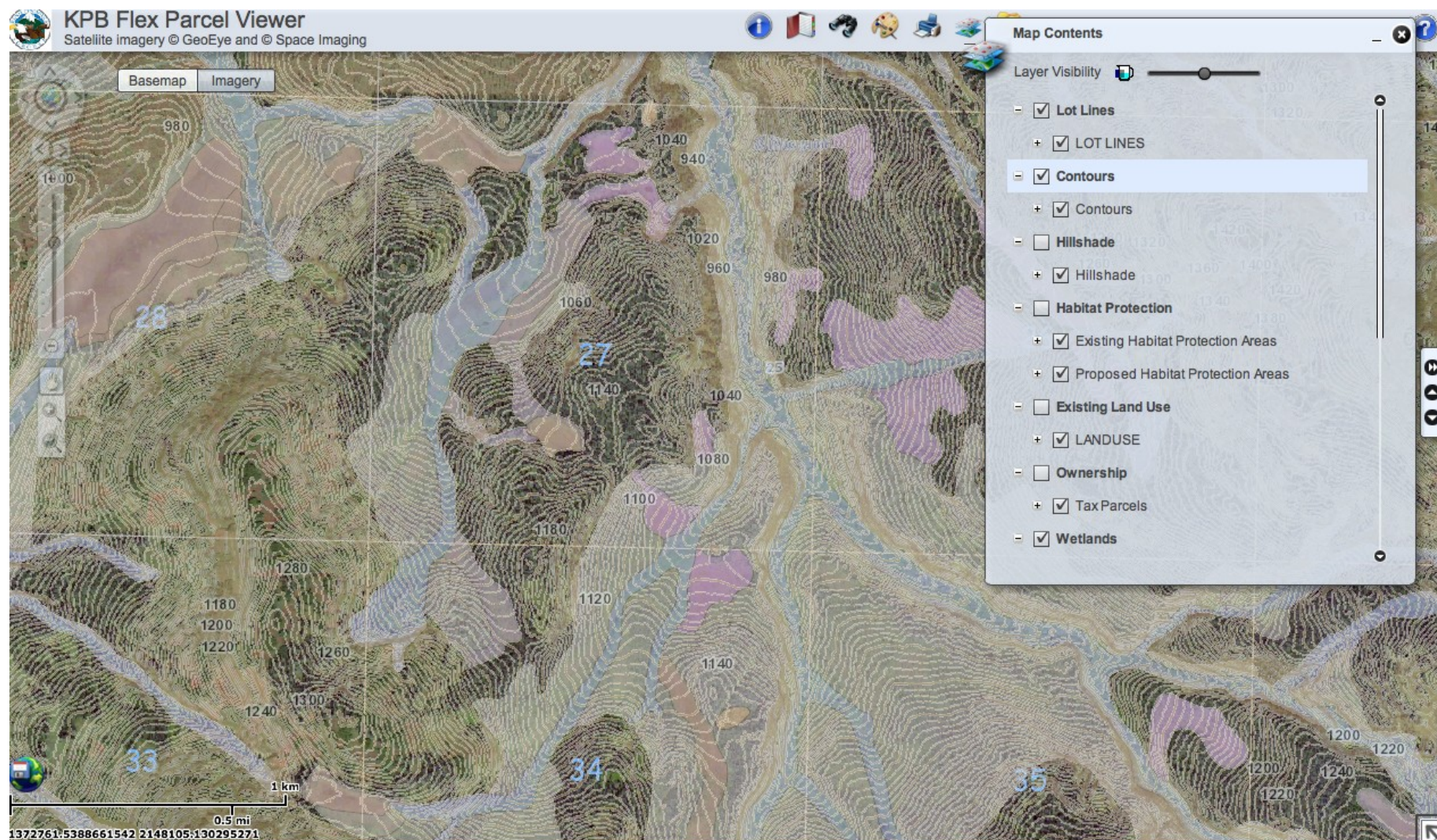
To end our exploring with the IPV, we switch over to the flexviewer version, at <http://mapserver.borough.kenai.ak.us/flexviewer/>. (At the beginning of this article, we showed another way to get to flexviewer.) Again, we'll go to river mile 25 of Stariski Creek and set the slider to 1:15,600, but now the screen looks like the **map below**. At the top we see the toolbar introduced at the beginning of this section, and we see that all the navigation tools are now located with the slider on the left. (Clicking the ? at the top right of the screen opens the flexviewer help file, <http://www2.borough.kenai.ak.us/GISDept/help.html>.) The state plane coordinates of our cursor location now show below the bar scale, bottom left, and a button for a thumbnail “overview” map is located in the bottom right corner of the screen. River mile 25 is in the center of our screen. You can see by the shaded button near the top left of the screen that our background is *Basemap* rather than *Imagery*. The first thing we do is switch to *Imagery* by clicking that button.



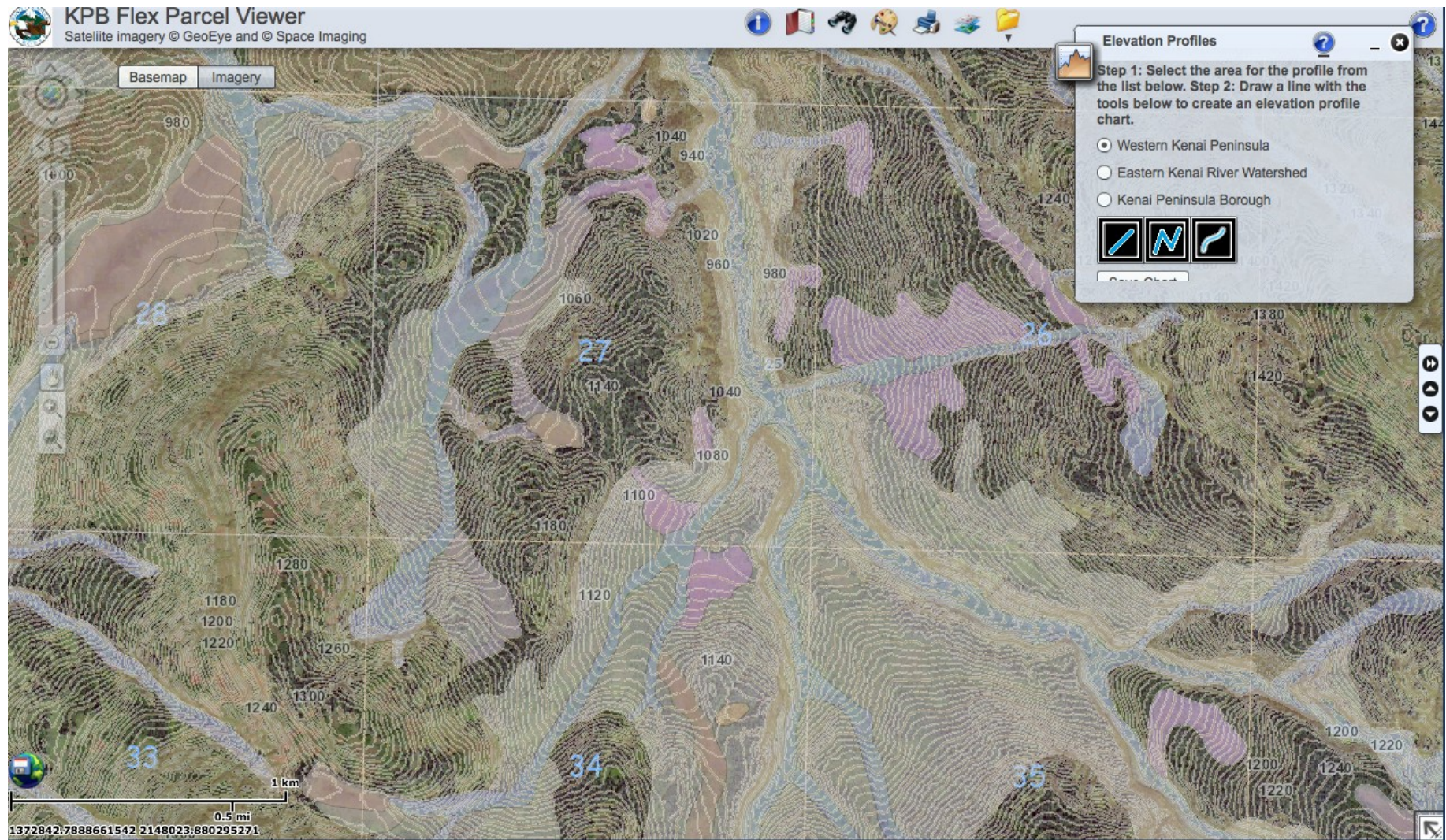
As soon as we click on the *Imagery* button, the IPV loads the **image below**. In the flexviewer, we can keep this image visible even if we open other map layers with the *Map Contents* icon. Here we show the dropdown menu that appears when you click on that icon. (Not all map contents choices show up at once, use the slider on the right of the dropdown menu to get to the choices that are listed below “Wetlands.”)



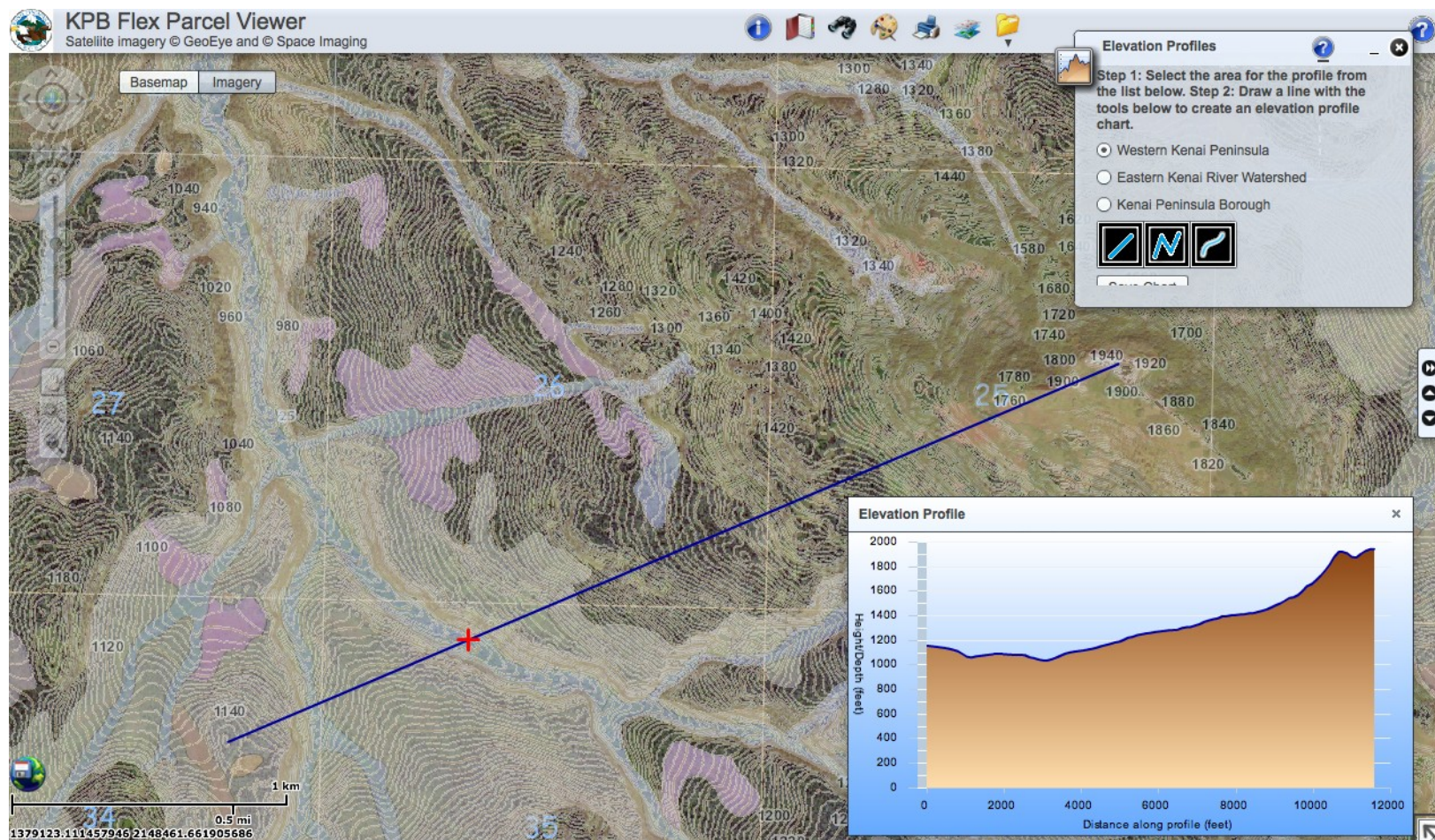
In the **image below** we've clicked on BOTH “Contours” and “Wetlands” from the dropdown menu under the *Map Contents* icon. (“Lot Lines” are also checked.) We've left the dropdown menu open for the moment, but we could close it by clicking the **x** in its upper right corner. “Contours” is highlighted because we just adjusted the “visibility” (brightness) of this layer with the slider labeled “Layer Visibility,” found at the top of the dropdown menu. We set both “Contours” and “Wetlands” to a visibility of 50%. With the contours turned on, we can see that river mile 25 is at an elevation of roughly 980 ft. If we wanted to see contour lines more clearly, we could just zoom in.



In the **image below**, we've clicked on the *Miscellaneous Tools* icon (the yellow folder on the far right of the toolbar), and from its dropdown menu, we selected "Elevation Profiles." That brings up the box shown in the upper right of this image. The "Elevation Profiles" box allows us to, first, draw a line on the map, and then, see elevations along that line in a profile view, as shown on the next page. We can choose to draw a straight line, a jagged line, or a curving line by selecting from the three buttons in the box. We will choose to draw a straight line.

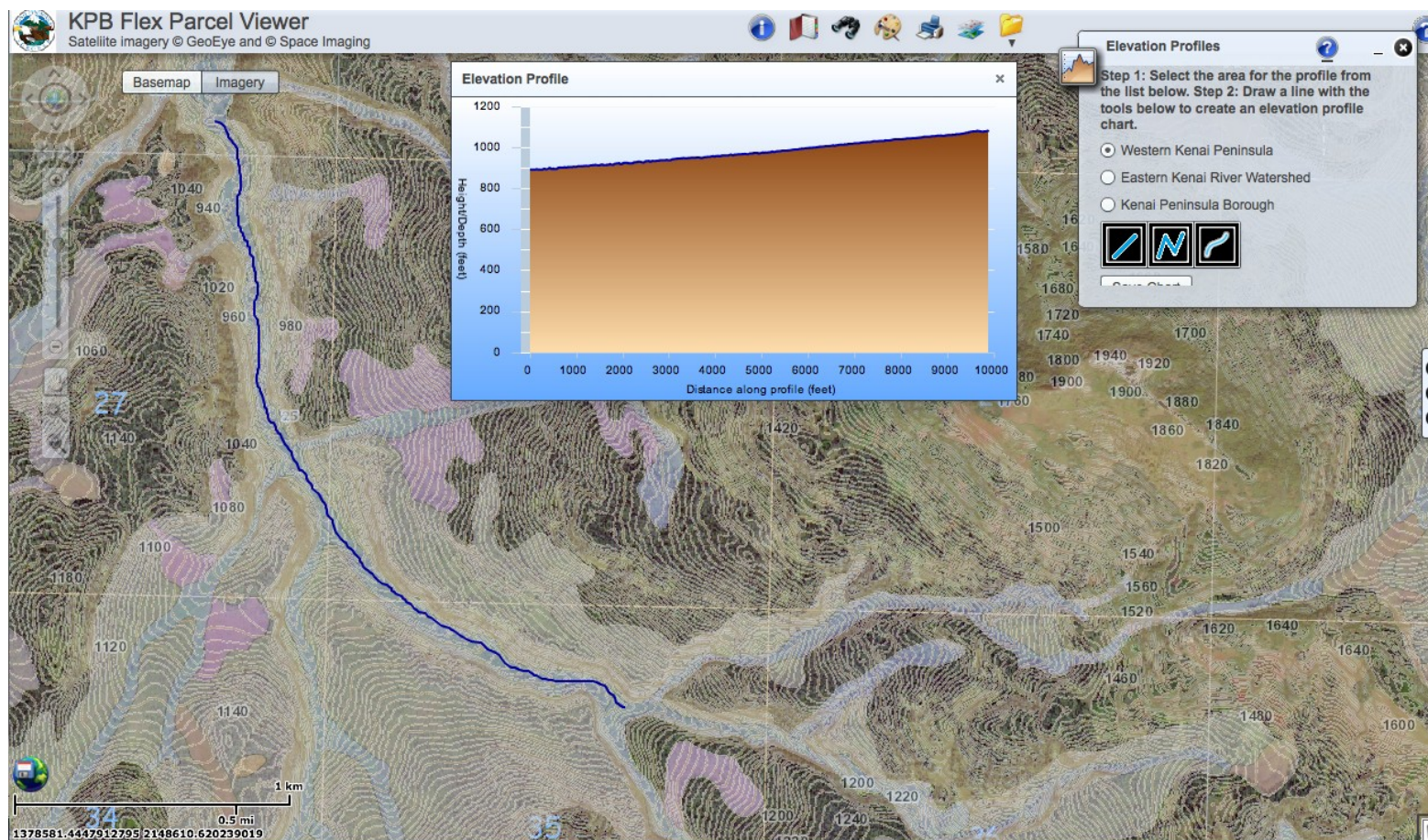


In **this image**, we first panned to the left to make visible some higher slopes on the right of the image. Then from the “Elevation Profiles” box, we selected the straight line choice. (See the previous page to see how we opened the box.) Then we drew a straight line from an elevation on the left of about 1,140 ft, to the top of a knob on the right with an elevation of about 1,940 ft. (This knob looks something like a glacial “drumlin,” see [Landforms](#) in the watershedipedia.) Once we finish drawing our line, the “Elevation Profile” image appears. Our line moves up the western flank of the [Caribou Hills](#). Once we have an elevation profile like this, we can move our cursor along the profile shown, and elevations at each point will be reported. For example, there are two channels in our cross section, one of which is slightly wider. We’ve marked that channel with a red cross, and from the elevation profile, we learned that the red cross is at an elevation of just about 1,037 ft. (The bottom of the smaller channel is at an elevation of 1,060 ft.) By moving our cursor along the elevation profile, we also learned that the highest point, on the far right, is at 1,944.6 ft, and that this point is 11,577.3 ft from the line's starting point on the west, a distance of just under 2.2 miles.



In the image below, we chose to draw a curving line along a segment of Stariski Creek channel to generate the elevation profile shown. The actual stream channel would have even less slope than this “longitudinal profile” because of all its **meanders**. This second elevation profile starts at 893.5 ft high on the northwest and ends at an elevation of 1,084.2 ft, almost 9,867 ft southeast from the starting point. That's a gain of about 191 ft in elevation over a linear distance of roughly 9,867 ft, which equals an average channel slope of about 1.9 percent—and the slope is even lower than that considering meanders. This suggests a channel in which even small salmon would not need to fight strong currents, but could instead find slow flows and abundant food from riparian shrubs. This suggests good salmon rearing habitat. (To calculate percent slope, determine total elevation change along the line drawn, then divide elevation change in feet by the length of the line in feet; multiply by 100 to get percent slope of the line, a rough approximation of channel slope.)

This ends our visit to Starkisk Creek using the borough's interactive parcel viewer. We've barely scratched the surface, but we hope this shows that these remarkable tools can help you explore ANYWHERE in the Anchor River, Deep Creek, Ninilchik River, and Stariski Creek watersheds in amazing ways.

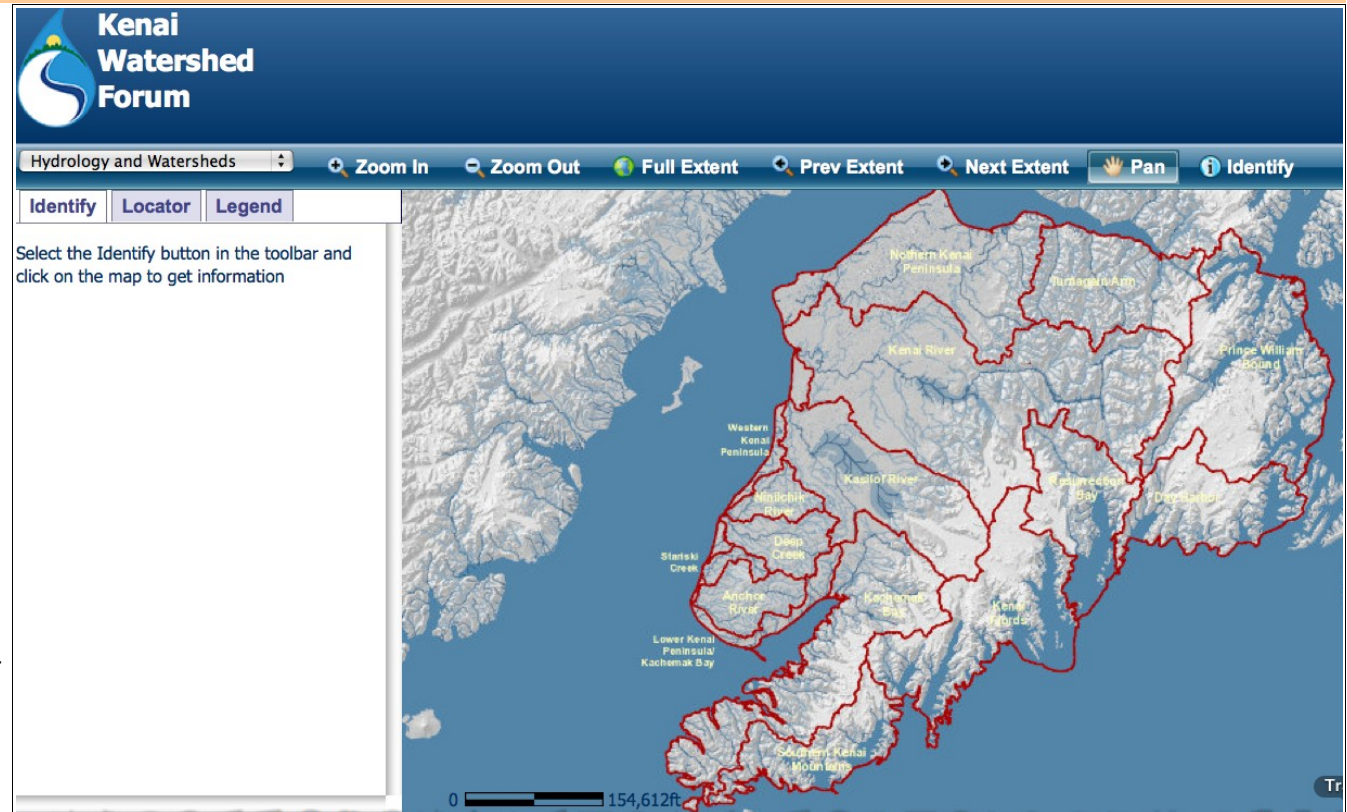


2. The Kenai Watershed Forum Atlas

If you want quickly to find a wealth of geospatial information compiled in terms of watershed boundaries and available at one website, the Kenai Watershed Forum's atlas is the tool to use. Click on this link:

<http://www.kenaiwatershed.org/Atlas/index.html> and the **image at right** should load. This map shows all watersheds covered in the KWF atlas, the largest being the Kenai River watershed.

The button under the Forum's logo is set on “Hydrology and Watersheds” when the atlas opens, but if you click on the arrows on its right, a dropdown menu appears. That menu is the key to the wealth of information found in the atlas. From that menu, you can go to 13 different layers (which KWF calls themes), plus a topic called “Kenai River Disturbance Index.” Atlas layers (themes) are listed in the table below. (For some background on the meanings of these layers, see: http://www.kenaiwatershed.org/atlas_metrics.html.)



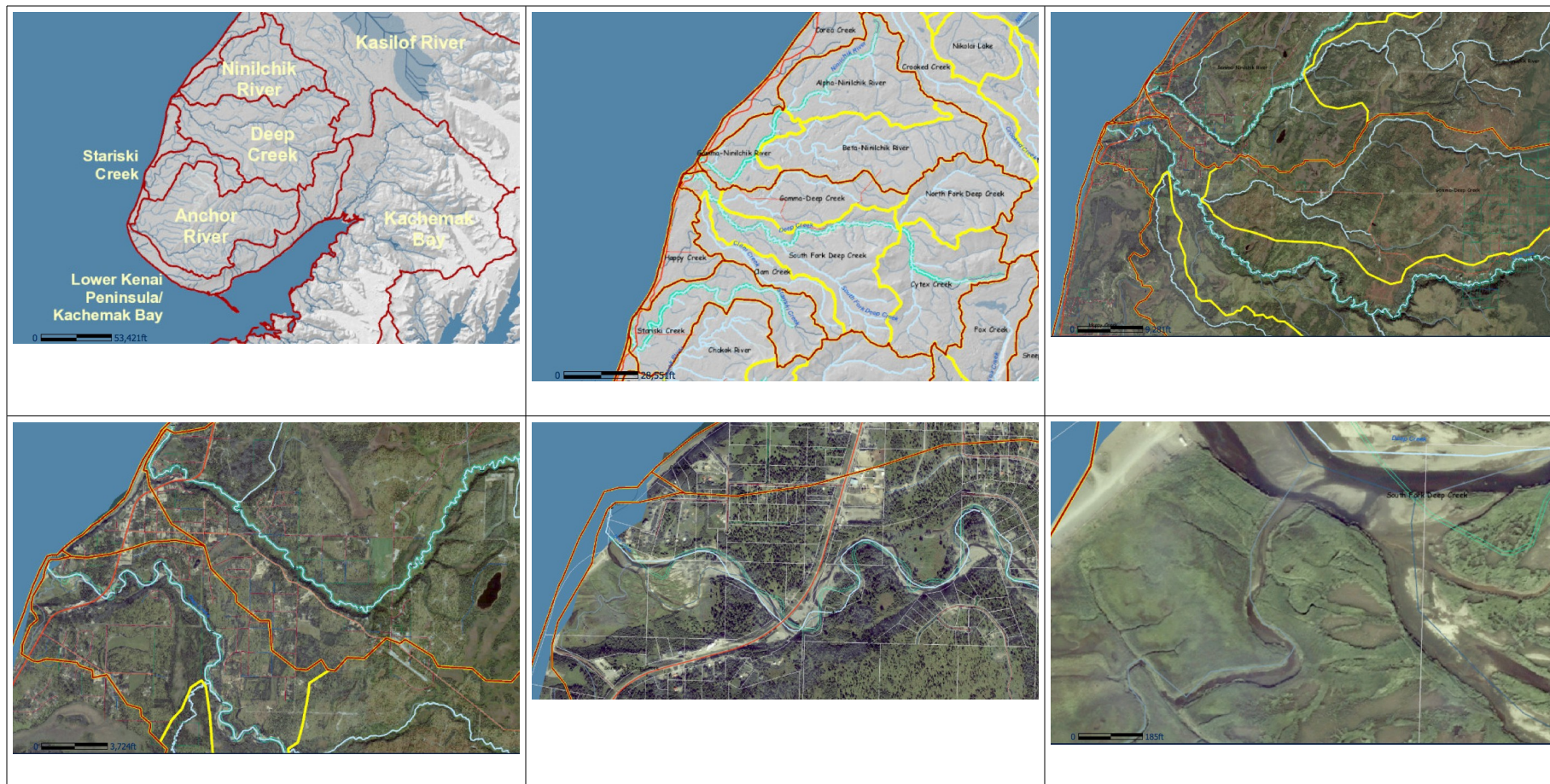
KWF atlas information layers

<ul style="list-style-type: none"> Hydrology and Watersheds Wetlands Land Use Land Cover 	<ul style="list-style-type: none"> Spruce Bark Beetle Wildfire Logging Land Ownership 	<ul style="list-style-type: none"> Soil Drainage Impervious Stream Crossing Invasives 	<ul style="list-style-type: none"> Footprints KR Disturbance Index (applies just to Kenai River watershed)
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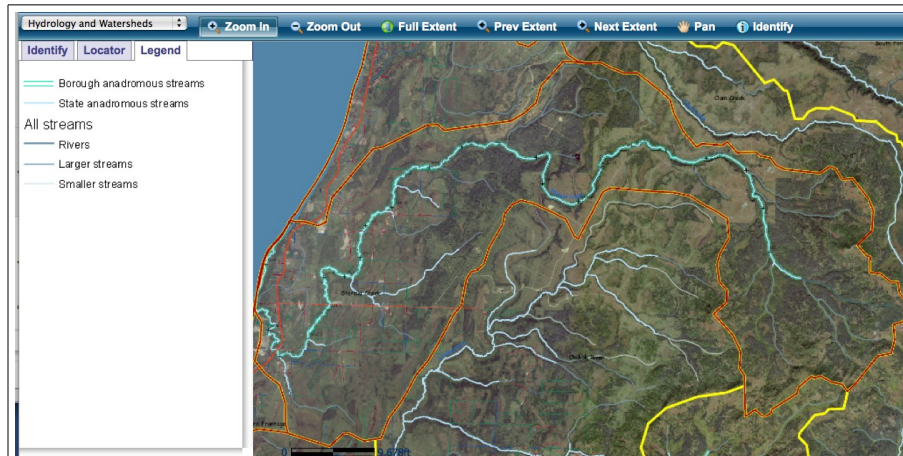
Some of this information is also available on the borough's interactive parcel viewer, discussed above, but what's particularly useful about the KWF atlas is that information is presented in terms of watershed and subwatershed boundaries.

To get to any of this information, first choose an area to look at. Click on the *Pan* button to move around the map. To zoom in, click the *Zoom In* button and draw a zoom box around an area, or click the *Identify* button and click twice on an area of interest. You can also go to named watersheds and sub-watersheds by clicking on the *Locator* tab (on the left of the screen) and choosing from the list that appears. As you zoom in, different levels of detail appear, as shown in the screens below. These images are all zooming closer to Ninilchik and the estuary at the mouth of Deep Creek. At any point, you can click the *Identify* button and click on an area to get more information. Once at an area of interest, you can choose a different information layer to view.

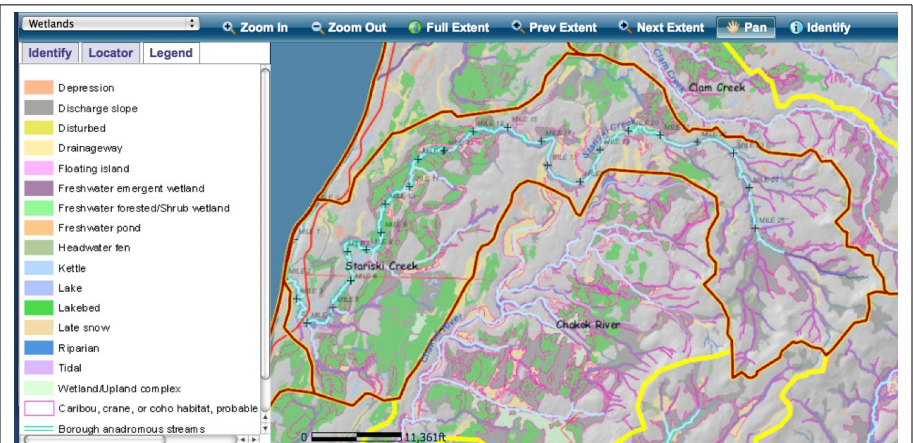
Maps below: zooming in towards Deep Creek estuary using the KWF atlas with the Hydrology and Watersheds information layer (theme) selected.



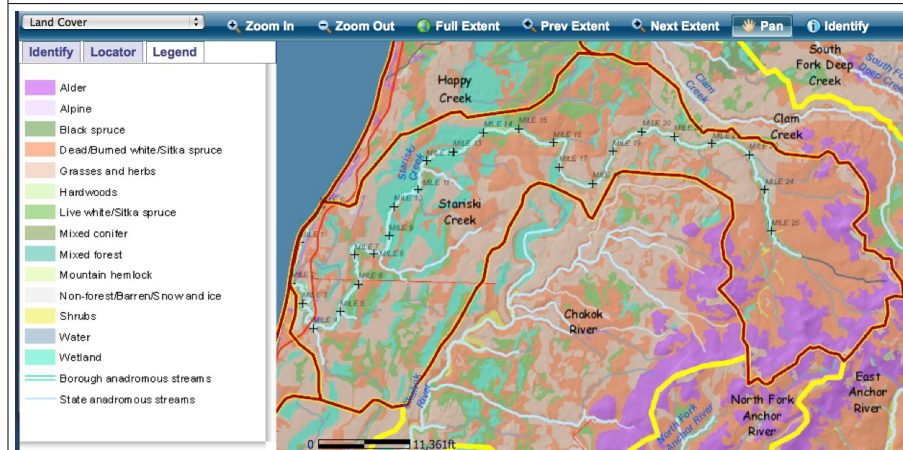
The images below and on the following pages provide examples of displays accessed under each of the KWF atlas layers. The layer and watershed are identified under each image. Again, as was the case with the “Hydrology and Watersheds” images shown above, the background layer will change as you zoom in, showing increasing levels of detail. In the following examples, the *Legend* tab on the left of the screen has been selected so that an appropriate legend will appear to the left of each map. (Legends are not very legible in these small examples, but you'll get the idea.) By first clicking the *Identify* button on the right side of the blue menu bar and then clicking in a polygon (distinct area) on any map, more specific data about the attributes of that polygon become available. To see this data, click on the *Identify* tab on the left of the screen, under the box showing the information layer, then click the little arrow on the right of each listed choice to see its associated data.



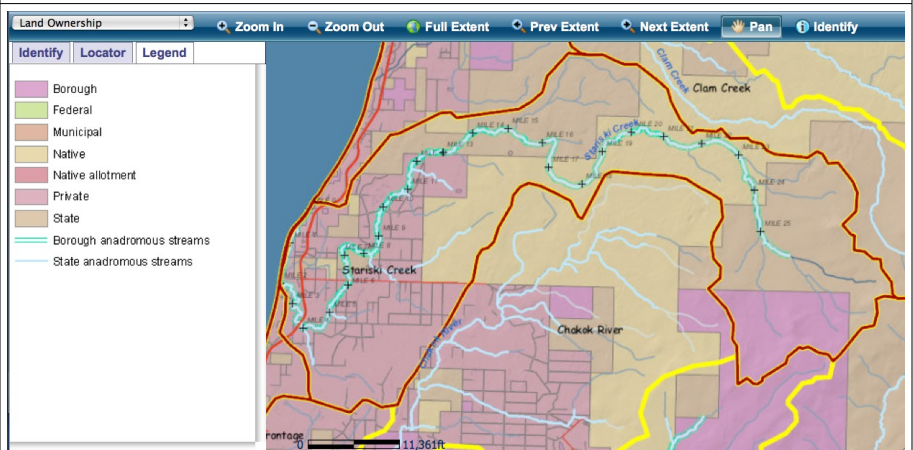
Stariski Creek and Chakok River – Hydrology and Watersheds



Stariski Creek and Chakok River – Wetlands

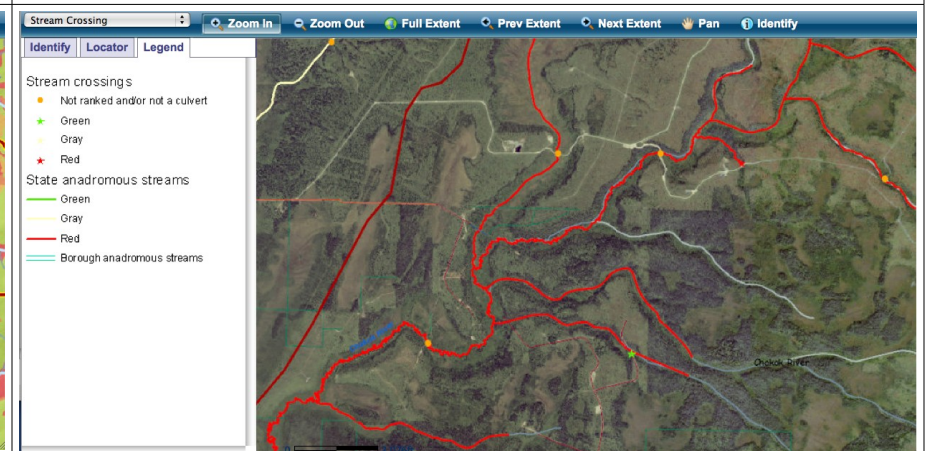
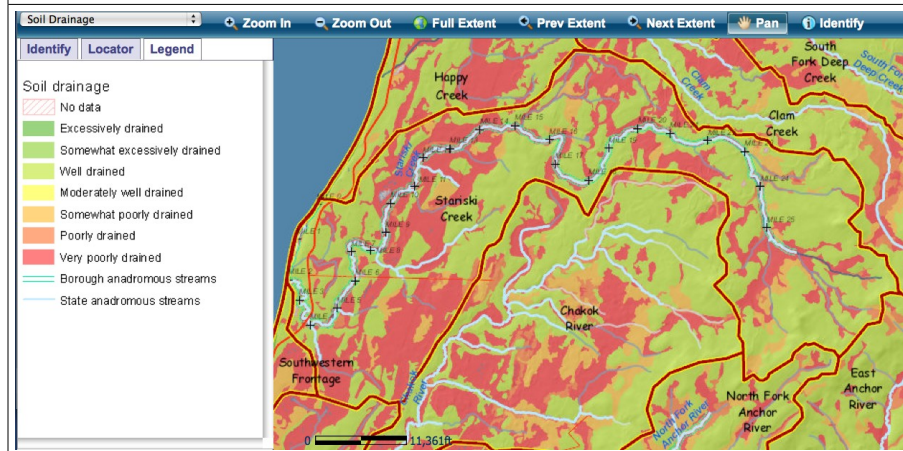
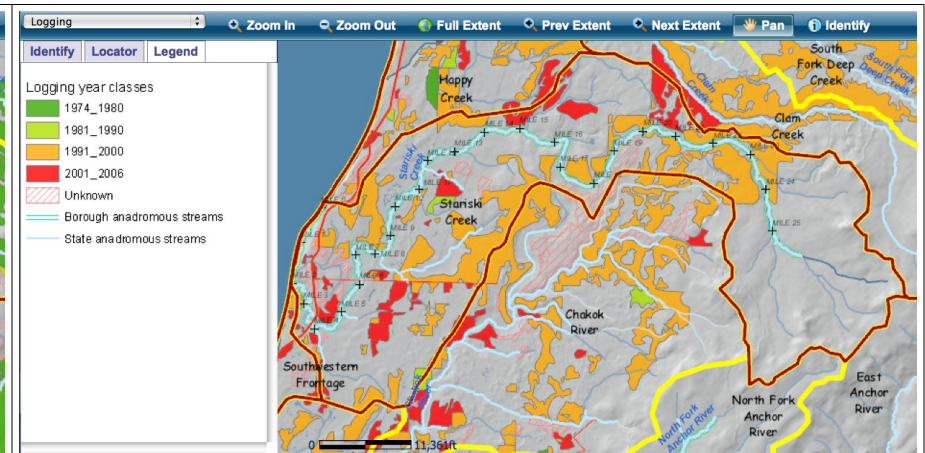
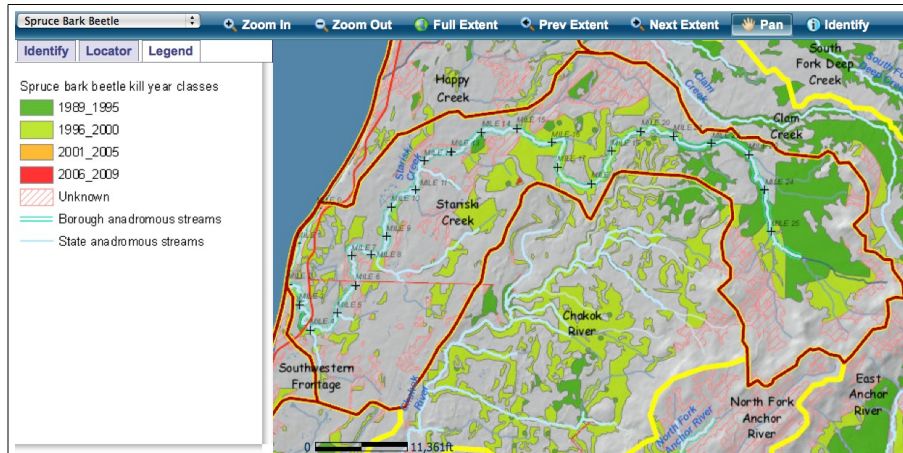


Stariski Creek and Chakok River – Land Cover

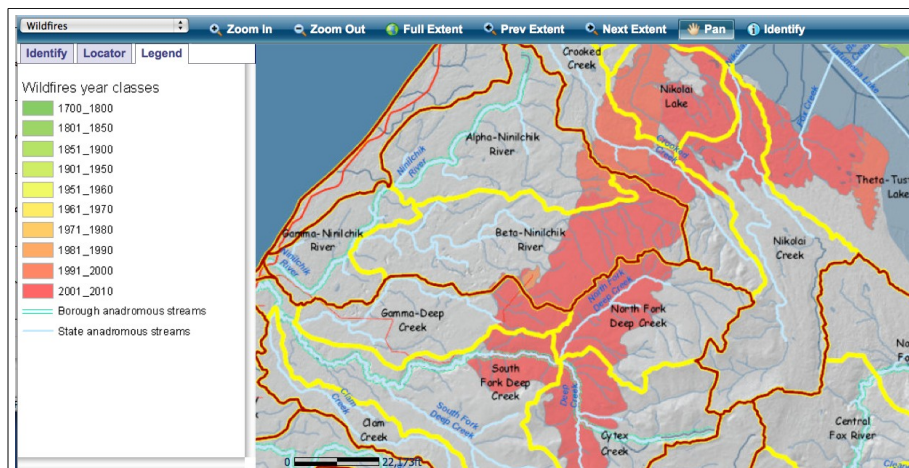


Stariski Creek and Chakok River – Land Ownership

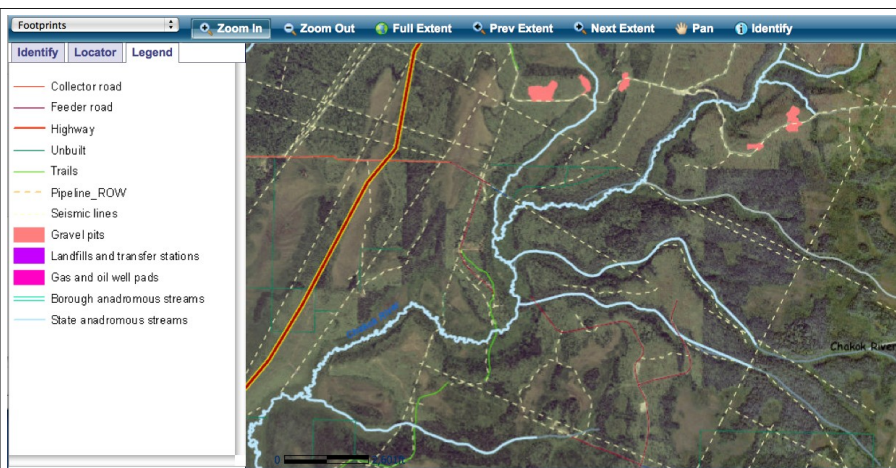
Below are some examples of information layers (themes) found in the KWF atlas (see discussion above).



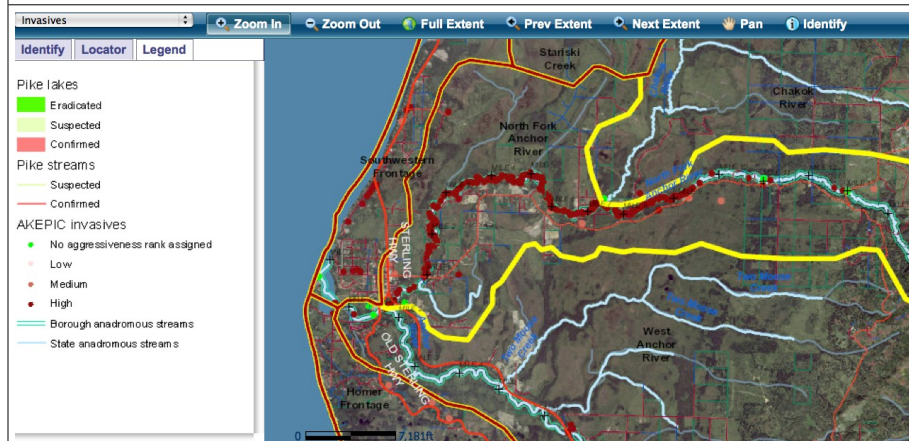
As you explore these maps and think about salmon, some questions may arise. What does it mean that so much of the North Fork of the Anchor River has a high level of “Invasives”? (See the two maps at the bottom of the table below; you can read about [Invasives](#) and [Reed Canary Grass](#) in the watershedipedia.) Why is so much of the North Fork and of Chakok River red on the “Stream Crossing” map? Maps like these can help landowners figure out what kinds of activities may be affecting salmon in harmful ways, and can help them work together to document and educate themselves and others about problems and possible solutions.



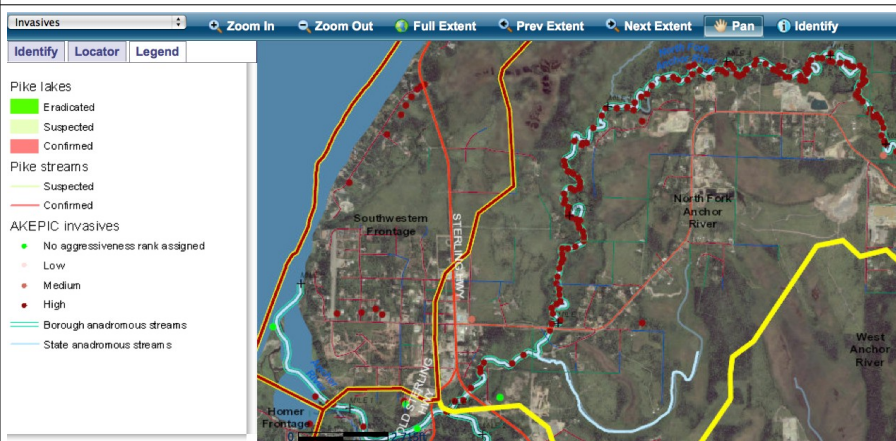
Deep Creek and Ninilchik River – Wildfires



Chakok River – Footprints (e.g., seismic lines, roads, gravel pits, etc.)



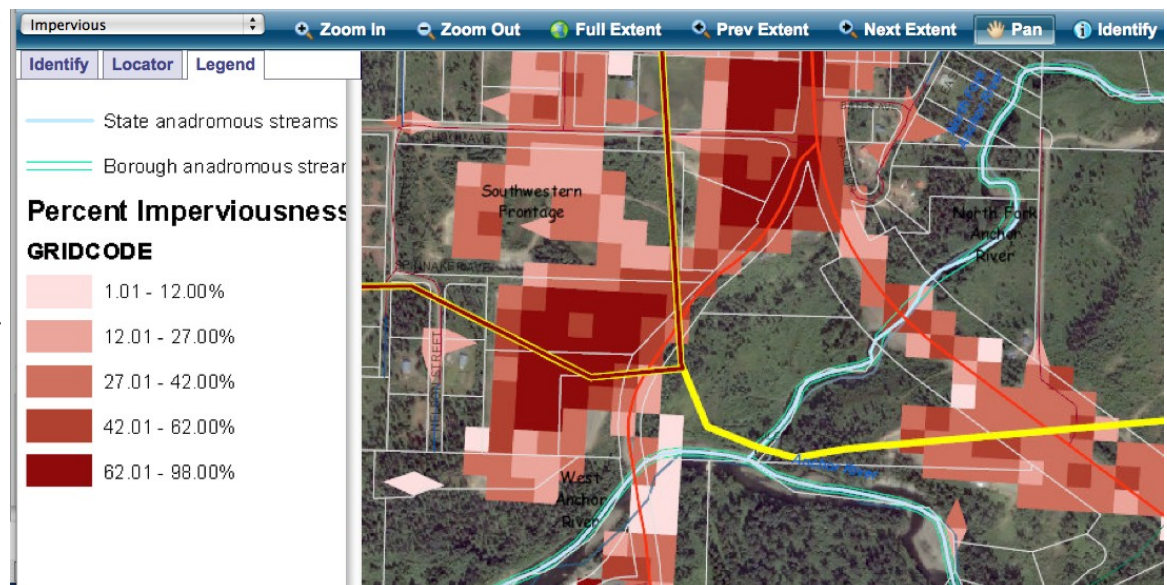
Anchor River – Invasives (zoomed out further than example to right)
(North Fork has a high level of invasive Reed Canary Grass)



Anchor River – Invasives (zoomed in further than example to left)
(North Fork has a high level of invasive Reed Canary Grass)

High levels of invasive plants, large areas of impervious surfaces, and locations where roads cross streams with culverts that obstruct fish passage of big or little salmon are some of the threats to local salmon populations. As explained in the watershedipedia, landowners can take many actions to reduce these threats.

Again, as in our introduction to the Kenai Peninsula Borough's interactive parcel viewer, this discussion of the KWF atlas has barely scratched the surface. Exploring watershed areas of interest to you with the atlas can help develop a much broader and deeper understanding of the ever-changing conditions and landscapes characteristic of your watershed. Keeping watersheds salmon friendly will take all of us doing everything we can to keep changing conditions and landscapes within natural ranges beneficial to salmon of all ages and life stages.



This map shows the green channel of the lower Anchor River turns red near the North Fork.

The zoomed-in maps above and below show where the North Fork of Anchor River goes under the Sterling Highway. As the “Stream Crossing” map below shows, this crossing needs to be improved for salmon passage.

