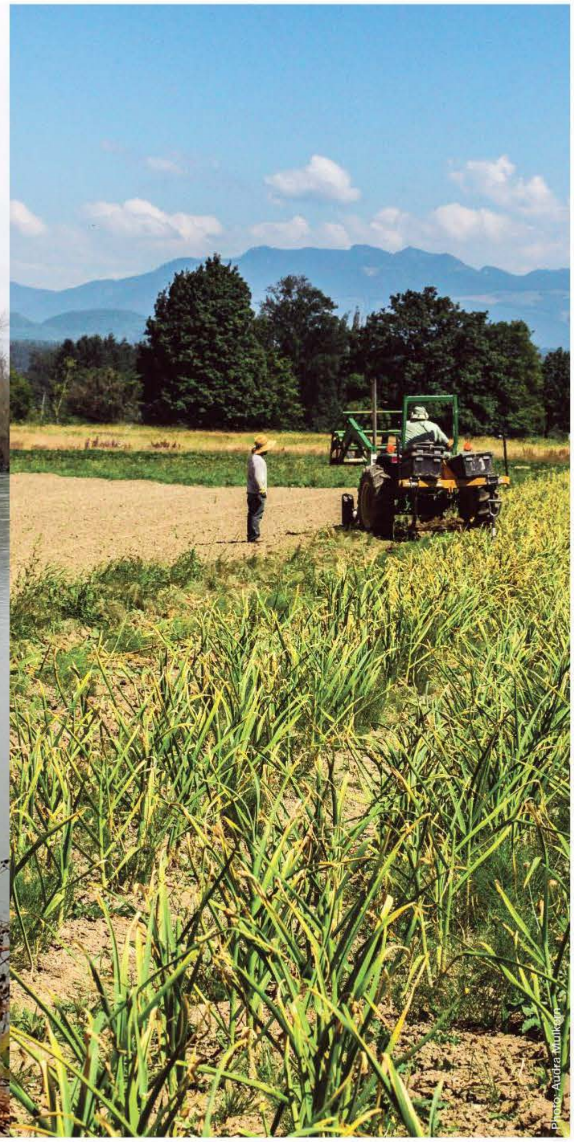
Snoqualmie Valley Agricultural Production District
Riparian Restoration and Agriculture Partnership Building

REACH SCALE PLAN



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King County
Department of
Natural Resources and Parks
Water and Land Resources Division

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Reach Scale Plan

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Acknowledgements

Two colleagues were responsible for the genesis of this work, but retired before it substantively moved forward: Gino Luchetti, whose relentless curiosity about decision models and skill in applied research led him to the USFS work and to creating the conversation with our USFS colleagues that led to this partnership; and, Claire Dyckman, who for many years stood at the challenging nexus between fish and farm and flood issues and saw what Gino saw and brought it forward for consideration. In bureaucracies, everything moves forward or stalls depending on priorities; thanks to Kate OLaughlin for creating the possibility for Gino, then Kollin Higgins to work on a project that wasn't on their work plans. Similar thanks to Mark Preszler, who ran with a random hallway conversation and threw himself into the catalytic role that kept the work alive using much of his own time in the process, and then brought in Brett Randle – and to their managers, Doug Navetski and Curt Crawford, for allowing them to work on this project as well – we would not be where we are without such professional generosity. And a special thanks to Kim Harper, WLRD Grants Coordinator, for her awareness and seeing the potential in the Ecology-run NEP grant funds to move the EMDS work forward and to Ecology's Ralph Svrjcek who saw the ability to move forward the Snoqualmie Valley Fish Farm Flood (FFF) work, that he was participating in so fully, through this grant. Thanks to Josh Monaghan of the KCD, who was willing to shoehorn in the work on a grant application when he was in demand a hundred different directions, and who also worked with and on behalf of the farm community to make sure that principles of the FFF dialogue were reflected in the grant application. And a special thanks to our grant coordinators, Carrie Byron and Colin Hume of Ecology, who took a risk on this approach, held the line on Ecology requirements, but also understand what it takes to do work like this.

This is just one small step forward of a thousand steps that are needed to build trust and work through the "wicked problem" of recovering salmon and forwarding thriving agriculture in the Snoqualmie Valley. This small step forward happened because of an outstanding project team. First, thanks to our remarkable USFS colleagues and partners, Drs. Keith Reynolds and Paul Hessburg- wow, what a privilege to work with these two professionals who have relentlessly pursued the development of transparent decision making approaches that span the range of technical and social skills needed in this work. Deep thanks to Megan Webb, who has done a superb job of project management, keeping relationships strong while sharply managing the scope, schedule and budget. The core team of Kollin Higgins, Brett Randle, Josh Monaghan (KCD), and Rick Reinlasoder (with a strong nod towards the tenacious Cynthia Krass (WID)), had the grit and the smarts to move this project forward through the rigorous workshops and discussions required in this approach. And thanks to the riparian experts and farmers who took time to wrestle with the substance and help move this all transparently forward.

While this is just a small step forward, it is so encouraging to see what is possible when people of deeply different viewpoints come together toward the goal of mutual gain in areas where no easy solutions present themselves. We now have the skeleton of a path for where to focus limited funds on best riparian areas with least impact to agriculture. We also have clearer ideas on where best to gather agricultural data to create the possibility

for more robust decision models. We will look forward to finding ways to move this work into deeper and richer outcomes for a variety of other problems at the fish farm flood interface in the months ahead.

Joan Lee, Management Project Sponsor, Rural and Regional Services Section Manager

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1.0 INTRODUCTION

The goal of the Snoqualmie Valley Agricultural Production District (SVAPD) Riparian Restoration and Agricultural Partnership Building project (the project) is to build upon the progress made through the Fish Farm Flood (FFF) Advisory Committee process. The project will accomplish this goal by developing Ecosystem Management Decision Support (EMDS) system models to transparently identify riparian restoration opportunities with minimal to no impact on agricultural lands. The planning area (the focus reach) encompasses the mainstem Snoqualmie River from Fall City to Carnation, including two adjacent tributaries (Figure 1).

Over the last one hundred years or more within the focus reach, natural vegetation has been converted primarily to increase the productive potential of farming. King County has recently reinvigorated its emphasis on the importance of preserving and increasing productive agricultural lands. King County also has a several-decades' long commitment to restoring habitat for aquatic species conservation--particularly salmon recovery--and water quality preservation.

An unintended consequence of the long history of land conversion for farming is that natural vegetation adjacent to streams and rivers (riparian areas) that provide vital food, shade, and water quality benefits for aquatic species have been removed or degraded in most of the riparian areas in the Snoqualmie Valley Agricultural Production District (SVAPD); restoring and protecting riparian buffers in the SVAPD is critical for both salmon recovery and water quality. Although King County, King Conservation District, Snoqualmie Watershed Forum, and several Non-Governmental Organizations (NGOs) are working to restore riparian areas in the SVAPD, agricultural landowners face multiple barriers to participate in these efforts, both individually and as an economic sector.

King County policy requires progress in both salmon recovery and agricultural food production. Historically, it has been difficult to make progress in one area without undermining the other. To address this difficulty, King County engaged in the Snoqualmie Valley FFF process, a collaborative process that is building trust among fisheries and farming representatives through the identification and implementation of priorities. The project is intended to contribute to the collaborative FFF process and test the ability of a transparent model such as EMDS, and the model development process, to provide a basis for mutual decision making relative to fisheries and farming interests.

To that end, King County partnered with model developers at the United States Forest Service (USFS), and the King Conservation District (KCD) to complete the SVAPD Riparian Restoration and Agriculture Partnership Building Project (the Project). A National Estuary Program Watershed Protection and Restoration Grant, administered by the State of Washington Department of Ecology, funded the Project. Representatives from the fisheries and farming community participated in the project through a stakeholder outreach process.

2.0 THE BIG IDEA

King County and its partners are testing the ability of EMDS to help develop collaborative approaches to solving wicked problems – those problems where creating good outcomes for one sector unintentionally damages another. For this project EMDS was used to provide for transparent and logical determination of land segments that, when protected by an easement, will simultaneously provide high chinook habitat riparian function, with little to no impact on farmability in the south SVAPD. The EMDS method has been effective at solving difficult problems in the past because it provides for consideration of scientific, policy, and affected parties' concerns. Further, proper implementation of the EMDS process requires and thrives on broad participation to build, test, refine, and validate model results. The EMDS process will allow King County to strive to meet the grant objectives of acquiring long-term easements for riparian enhancement on a reach wide basis. If this project proves successful, funding and capacity can be sought to further develop this transparent and participatory process which, over time, may allow for broader riparian restoration in more locations than initially contemplated in this pilot project. EMDS may also prove a valuable technique for future use by the County and others in the greater Puget Sound region.

3.0 BACKGROUND

3.1 The Focus Reach

The focus reach is located within the Snohomish Watershed, or Watershed Resource Inventory Area (WRIA) 7, and is entirely in unincorporated King County. The focus reach includes almost 5,000 acres of land, 10 miles of the Snoqualmie River, and 37 miles of associated streams (Figure 1). The planning effort focused on the riparian areas associated with the mainstem of the Snoqualmie River between Fall City and Carnation, plus the mainstems of the two largest tributaries in the Snoqualmie River reach, Patterson and Griffin creeks. Riparian planning efforts examined the mainstems of the Snoqualmie River and Patterson and Griffin creeks, while agricultural planning included the entire 5,000-acre southern portion of the SVAPD. This area was chosen due to its high priority for salmon habitat restoration (see WRIA 7 Salmon Habitat Plan), its high level of riparian restoration need, and its relatively low levels of County agricultural protection easements that would make creating a riparian easement very challenging.

3.2 Planning and Regulatory Frameworks

The focus reach has a variety of overlapping regulatory frameworks. The locally and federally approved WRIA 7 Salmon Habitat Plan (the 'Salmon Plan') evaluated this focus reach and identified various restoration priorities, including riparian restoration targets. Much of the focus reach is susceptible to flooding. According to King County Geographic Information System (GIS) data, approximately 79% of the focus reach is located within the 100-year floodplain and almost 60% is mapped as floodway of the Snoqualmie River. The entire study reach directly overlaps the southern half of the SVAPD, thus 99% of the land in this area is zoned for agricultural use, with the remaining 1% zoned rural residential. Slightly over 17% of the focus reach has either Farmland Preservation Program (FPP) or Transfer of Development Right (TDR) agricultural easements applying to the land. The County drafted its Shoreline Master Plan's (SMP) applicable jurisdiction to include frequently flooded areas and the SMP applies to 82% of the focus reach, with the County's Critical Area Ordinance (CAO) applying to the areas of the focus reach not covered by the SMP. While most of the area is covered under the County's SMP, many of the regulations within the SMP are cross referenced with the CAO. These regulations greatly limit new agricultural clearing within functioning wetland and stream critical areas (and their buffers), but grandfather agricultural activities present prior to 2005 when the CAO was adopted.

On August 4, 2011, the Environmental Protection Agency (EPA) approved a Total Maximum Daily Load (TMDL) for temperature on the Snoqualmie River (Snoqualmie River Basin Temperature TMDL, 2011). Data have confirmed that temperatures in the Snoqualmie River watershed have exceeded standards during the critical period for fish and have periodically risen above lethal levels. The TMDL study identified what needs to be done in this watershed to protect or reduce water temperatures in the Snoqualmie River watershed. These actions include controlling the discharge from wastewater treatment

plants, improving riparian shading to sustain cooler temperatures, controlling water withdrawals, and improving instream habitat.

3.3 Reach Context

3.3.1 Effects of Past Land Use

The Lower Snoqualmie River floodplain area has undergone significant change over the last 150 years. Collins and Sheikh (2002) noted that in the lower 40 miles of the Snoqualmie River, which includes the focus reach, approximately 81% of floodplain wetlands were converted to agricultural use and almost 84% of the floodplain forest was cleared primarily for agriculture. As part of the agricultural development in this valley, landowners and managers have installed revetments and other bank armoring to protect their homes and farms from the powerful, erosive forces of the river. Based on King County GIS data, approximately 40% of the banks of the lower Snoqualmie River are armored, while 44% of the banks within the focus reach are armored. Much of this focus reach's armoring is further concentrated in the six miles below the Raging River, with armor present on 58% of this reach's banks.

King County recently classified all the streams and channels within the Snoqualmie floodplain for agricultural drainage assistance programs (Lucchetti et al., 2014). That classification shows that between 57% and 65% of the smaller stream channel length in the focus reach was straightened or channelized for agricultural purposes. It is acknowledged that for full salmon recovery these streams may need riparian and aquatic restoration actions in the future, but they are not the focus of this pilot project.

For this work, a 150-foot buffer has been identified as a scientifically defensible target established in the Salmon Plan, as well as the target which Ecology asked us to work towards in providing the funding for this effort. An analysis for FFF showed that for all watercourses within the focus reach only 33% of the 150-foot buffer currently has trees in the buffer. This is a total sum of the treed acres within the 150-foot buffer area and does not mean that the buffer is contiguous or of any particular width. Approximately 55% (~875 acres) of the 150-foot buffer area was cleared and is currently in agricultural use (includes farm buildings and other structures as well as cleared land).

3.3.2 Agricultural Context

King County designated the SVAPD as "agricultural lands of long term commercial significance," with most of the area zoned for agriculture use, and has established a county-wide policy to increase farmland productivity by 400 acres per year. In addition, King County has several leading-edge funding programs including transfer of development rights and the Conservation Futures Tax to help preserve and grow the agricultural land base. As yet there is no specific strategic plan for agricultural lands in the Snoqualmie Valley. This puts agricultural parties at a disadvantage when collaborating with salmon habitat restoration and floodplain management proponents, which each have strategic plans that drive their actions. The FFF Advisory Committee process highlighted the need

for an agriculture strategic plan and developed a scope of work for such a plan. The purpose of the agricultural strategic plan would be to improve long term productivity of farmland, bring more acres into food production, among other purposes. This would occur through assessment of farm assets and needs, along with development of an implementation plan for improvements. The plan will complement other related efforts.

3.3.3 Current Conditions

3.3.3.1 Watershed

1. Geologic Context

The larger Snoqualmie watershed is nearly 700 mi^2 and located mostly within King County, with the downstream area located in Snohomish County. The Snoqualmie watershed has two primary physiographic regions, the Puget Lowland and the Middle Cascade Range. The lower Snoqualmie Valley was carved by continental glaciers and the Snoqualmie River has been slowly migrating across the alluvial valley bottom. The lowland area's geology is primarily a product of repeated continental glaciations while the upper watershed's geology is bedrock dominated and a product of alpine glaciations. The Snoqualmie River has three primary forks upstream of Snoqualmie Falls that join to form the Snoqualmie River near the city of North Bend. Upstream of North Bend, the three forks have a relatively steep gradient and an alpine character. The Middle Fork of the Snoqualmie River contributes approximately half of the water of the three forks and is also the warmest of the three forks (King County 2016). The reasons the Middle Fork is uncharacteristically warm are not well understood. The floodplain widens and the river's gradient decreases in the North Bend area. Around river mile (RM) 40, approximately six miles upstream and after the 270 foot drop over Snoqualmie Falls, there is a dramatic loss of gradient and the river continues downstream primarily as a single thread meandering river channel. The floodplain is subject to frequent overtopping flood events which have slowly built up natural levees along the banks of much of the lower Snoqualmie. This creates unique challenges because frequently the land near the river has the highest elevation on a property. Also, having the high ground next to the river means that the area does not generally provide the filtration function typical of riparian areas since water tends to drain away from the river and its riparian area versus towards and through its riparian area.

2. Land Use and Effects on Riparian Zones and Water Quality

Approximately 70% of the larger Snoqualmie watershed, especially the headwaters area, is forested. Significant portions of the basin are located within the Federal Alpine Lakes Wilderness and Mount Baker-Snoqualmie National Forest. Below Snoqualmie Falls, the land use changes to primarily a mixture of forestry, rural residential, agricultural (~ 4%), and urban uses (~2%). Approximately 14,000 acres of the watershed are located within the larger Agricultural Production District.

As noted previously, the focus reach is an exact overlay of the southern half of the SVAPD. Thus, the primary land use affecting the riparian areas of the focus reach is agricultural use. The other main impacting land cover is road surfaces that are located within the 150-foot riparian buffer zone. This includes State Route 203 and 202, many County roads (such as Neal Road) that parallel the Snoqualmie River or streams, as well as a variety of paved and

unpaved farm roads. County maintained flood control levees and revetments also limit riparian corridor potential. Approximately 44% of the Snoqualmie River within the focus reach has a revetment or levee along the banks.

3. Condition of Watershed Processes

There are a variety of physical processes (e.g. hydrologic, geomorphic, water quality) that drive habitat conditions in the focus reach. The process of lateral channel migration is one of the more important overarching processes, which is affected by and integrates multiple habitat forming processes and anthropogenic actions. As noted above in the geologic background, the upper six miles of the focus reach has a slightly steeper river channel gradient caused by sediment inputs from the Raging River. Due to this gravel deposition, this six-mile stretch is one of four primary spawning reaches in the Snoqualmie basin. Beyond this six mile stretch, the river loses its competency to move large gravel, meaning that the bed of the river becomes dominated by fine substrates.

Geomorphic processes that historically depend on channel migration and large, forested riparian areas are extremely important in the formation of habitat units that chinook and other salmonids use in various life stages. Channels that can move, recruit large wood and erode bank substrates and deposit sediments, along with their associated effects on stream morphology, form the habitat conditions that chinook and other salmonids have used in the past, and that were part of their evolution. Large wood recruitment is important in northwestern streams because it helps form pools, creates more complex edge habitat, provides refugia from high velocity flows and predation, and is frequently a driver of lateral channel migration. Unfortunately, the geomorphic processes so important to salmonid habitat sustainability are limited by anthropogenic actions of deforestation, channel armoring, and channel straightening. Much of the Snoqualmie mainstem and parts of the tributary reaches are armored, especially outside bends. To date there has been no channel migration study for the Snoqualmie River or the larger streams in the focus reach.

Riparian forests contribute to water quality through a variety of functions. One of the biggest contributions of riparian forest is the regulation of instream temperature through shade, which is especially important to salmonid species in the summer months. The Snoqualmie River banks are known to be lacking in large mature trees that existed historically, thus the extent of shade benefits from the existing riparian conditions are low. Riparian forests provide other water quality benefits through the filtration of nutrients from agricultural and other anthropogenic sources. These benefits are absent in many areas of the reach due to past deforestation.

3.3.4 Riparian Zone

3.3.4.1 Land Uses

The focus reach has a long history of agricultural use. The vast majority of property in the focus reach is zoned and used for agricultural production. Riparian buffers in this area were cleared to optimize agricultural production, with clearing frequently occurring to the top of the bank and armoring along outside bends to protect farms, farm infrastructure,

and farm fields from erosion. This historic and consistent clearing and armoring has had the unintended consequence of removing most previously functioning riparian areas.

King County's Livestock Management Ordinance (LMO) was passed in December 1993, but did not come into full affect in the SVAPD until 2005 when the fencing and buffer requirements were instituted. The LMO is intended to "support the raising and keeping of livestock in a manner that minimizes the adverse impacts of livestock on the environment particularly regarding their impacts on water quality and salmonid fisheries habitat in King County watersheds." One way the LMO is intended to address adverse impacts is through the completion of Farm Plans that promote agricultural Best Management Practices (BMPs). Although the LMO promotes the implementation of agricultural BMPs to reduce ecological and water quality impacts of typical agricultural operations, current agricultural BMPs are not ecological best practices. Thus, the current protection of riparian buffers offered by the LMO meets the King County code requirements while allowing agriculture to continue, but does not meet Best Available Science for buffer widths sufficient to protect and promote full ecological functions.

Grazing in and near riparian areas has affected riparian functions throughout the focus reach with direct damage (e.g. browsing) and indirect degradation (e.g. increased nutrient loading). While improvements have occurred with respect to water quality and cattle, there is more work to be done to identify and develop habitat improvements without creating unnecessarily burdensome regulations.

In several locations within the focus reach, the King County and Washington State road networks confine the potential riparian buffer width and occasionally this infrastructure precludes the entire riparian buffer zone. King County code allows new roads for agricultural use to be placed within the regulatory buffer of rivers and streams if that area is already cleared, so current policy does not sufficiently protect degraded riparian buffers from further increases in degradation.

3.3.4.2 Current and Potential Future Development Pressures

The focus reach is entirely within the southern SVAPD and primarily zoned for agricultural use. Risks of either downzoning or subdivision of parcels does not appear to be prominent now partially because of the zoning and partially because almost all the focus reach is within the floodway of the Snoqualmie River, limiting development options under flood hazard management federal, state, and local law. Most of the parcels in the focus reach are zoned A-35, which only allows one dwelling unit per 35 acres. There are non-conforming lots in the SVAPD, but further subdivision below 35 acres (for A-35 zoning) is not allowed under King County Code. Although King County Code has limited subdivision of parcels in the focus reach, some development pressures still exist through farm expansion activities on currently operational farms (though no substantive analysis of this observation has been performed). Examples of farm expansion activities that have degraded riparian functions include new farm roads and agricultural drainage projects in riparian areas. Such

farm expansion activities may be approved in regulatory buffer areas if those buffers are already cleared. Thus, one consideration for this project in pursuing sites with little or no impact to agriculture will be to look at the relative importance of a target riparian area with respect to future agricultural infrastructure. It may be necessary to explore compromises, particularly for drainage corridors, to meet overall project objectives.

3.3.4.3 Protection and Restoration Programs

Several protection and restoration programs are actively implementing projects and protecting property in the focus reach. These programs complement the riparian easement protection proposed by this reach plan. In some cases, King County may be able to develop partnerships to complete restoration of properties that are protected by the acquisition of conservation easements through NEP funds. Current protection and restoration programs include the Salmon Recovery Plan, Snoqualmie Forum's Cooperative Watershed Management program, King County Million Trees Initiative, King County Small Habitat Restoration Program, and United States Department of Agriculture's Conservation Reserve Enhancement Program (CREP).

1. Salmon Recovery Plan

The Snohomish Basin Salmon Recovery Forum created a Salmon Conservation Plan to organize and formalize salmon restoration efforts in the Snohomish River basin. Multiple jurisdictions, Native American tribes, NGOs, and other public entities worked together to create the plan. The plan is a direct response to the listing of chinook and bull trout in the Endangered Species Act and seeks to reverse the decline in both species. The Salmon Plan recommends both riparian restoration and larger aquatic habitat projects, with many entities undertaking the work outlined in the plan.

2. Snoqualmie Watershed Forum

The Snoqualmie Watershed Forum is a partnership between the Snoqualmie Tribe, the Tulalip Tribes, King County, the cities of Duvall, Carnation, North Bend and Snoqualmie, and the Town of Skykomish. These partners have entered an interlocal agreement to work together on watershed issues. Members include elected officials from each of the eight jurisdictions and three citizen representatives, as well as a non-governmental organizations representative and the King Conservation District. Since 1998, the Snoqualmie Watershed Forum has helped implement projects that move toward salmon recovery, protect water quality and address flooding along the Snoqualmie and South Fork Skykomish rivers. The Forum operates in harmony with the cultural and community needs of the valley, respecting its unique and natural history. The forum has been one of the primary funders of riparian restoration projects within the Snoqualmie Watershed.

3. King County Million Trees Initiative

In 2016, King County partnered with local non-profits and businesses to confront climate change and improve the health of natural habitats and neighborhoods across the County by committing to plant one million trees by the year 2020. King County recognizes the positive impact that trees have on air quality and water quality. Trees planted as part of riparian restoration in the SVAPD will complement the King County Million Trees Initiative and help King County combat climate change.

4. King County Small Habitat Restoration Program

King County's Small Habitat Restoration Program (SHRP) implements streamside and wetland planting, livestock fencing, in-stream habitat improvements, removal of barriers to fish migration, and removal of invasive/non-native plants. SHRP projects are designed to be low-cost projects that are often implemented on private land.

5. Conservation Reserve Enhancement Program

The CREP is a federal land conservation program that targets high-priority conservation concerns on private land and is administered locally through the King Conservation District. In exchange for the voluntary removal of environmentally sensitive land from agricultural production and establishment of resource conserving plant species, the CREP provides annual payment (for a contract period, typically 10 years) to private landowners. Once the CREP contract period ends, the landowner may be free to return the property to its prior use. Since CREP projects are not considered permanently protected by regulations according to King County Department of Permitting and Environmental Review (KCDPER), King County WLRD may be able to leverage recently restored land that may be cleared of riparian vegetation when the CREP contract ends by acquiring permanent conservation easements.

3.3.4.4 Infrastructure that May Impact Easement Opportunities

1. Roads

Historically, dirt trails were developed along the existing high ground or the path of least resistance with the primary objective of connecting people with water. These dirt paths were later developed into roads and in the focus reach many of these roads were constructed along the Snoqualmie River and its tributaries. Because roads were built within riparian buffer areas, county, state, and private roads will impact the protection and restoration opportunities in the focus reach. Roads, including portions of SR 203, West Snoqualmie River Road SE, and Neal Road, to name a few, parallel portions of the Snoqualmie River. Opportunities for riparian protection and restoration will be limited where current road infrastructure is in place.

2. Agricultural Infrastructure

In some cases, agricultural infrastructure including houses, barns, sheds, and other agricultural support structures are located within the riparian buffer. These were usually sited on the higher, more stable ground on the farm. On many farms in the focus reach, the highest ground for farm buildings is located close to the river or along the valley wall. These existing infrastructure elements will limit the availability of land for riparian protection and/or restoration in some areas. Where riparian restoration is an option, moving or decommissioning existing agricultural infrastructures will significantly increase the cost of riparian restoration.

3. Revetments and Levees

Per King County GIS, approximately 44% of the banks of the Snoqualmie River in the focus reach are protected by a levee or revetment. These protections were installed to limit river impact to farm buildings, homes, roads, and farm fields. The protected banks limit the functions of a riparian buffer and can make replanting riparian buffer more challenging if

the rock protections are left in place. Riparian buffers areas with levees or revetments may provide opportunities for larger restoration efforts through levee setback projects, but these projects are exponentially more expensive to design and implement than planting or simply protecting an existing riparian buffer and were not considered at this time.

4. Actively Used Agricultural Land

Agricultural cultivation often occurs to the top of the bank of rivers and streams in the focus reach. Many farmers have pointed out that the relatively higher ground adjacent to the river can be valuable to their farming operations because this high ground offers a longer growing season and can experience less flooding. From a riparian restoration perspective, King County policies and agricultural preferences may limit opportunities to convert actively used agricultural land within a riparian buffer area back to functioning riparian buffer.

3.3.4.5 Stream Movement and Channel Migration

The channel migration zone is not currently mapped in the focus reach. Based on data created for this project, sixty percent of outside bends of the Snoqualmie River in the focus reach are armored, which greatly reduces the potential for channel migration and riparian buffer function. Currently, channel migration is occurring at the Upper Carlson floodplain restoration project, located in the Fall City Natural Area, where a levee built in the 1930s was removed in 2014. After two floods and less than a year, the channel widened an average of 40 feet and added 1.5 acres of new aquatic habitat. Other areas of the focus reach could see similar channel migration if armoring were not so prevalent.

3.3.4.6 Water Quality Conditions and Existing Impairment

The mainstem Snoqualmie River is impaired and subject to TMDLs for temperature, Ammonia-N, Biochemical Oxygen Demand (BOD) (5 day), and fecal coliform. Temperature is the greatest concern for the mainstem reach. King County scientists attribute warming to denuded riparian areas and bank armoring's disruption of tributary-mainstem connections (King County 2009).

Data collection on Patterson Creek has indicated poor water quality with excessive nutrients, plus fecal coliform, dissolved oxygen, and temperature standards violations. Water quality improved in Patterson Creek since initial data collection in 1989-1991. Patterson Creek met water quality standards for fecal coliform during the wet season (November-April) but during the critical period (August-October) water quality standards for fecal coliform are still not being met. Specifically, between the 1989-1991 TMDL Study and the 2003-05 Effectiveness Monitoring Study, the geometric mean fecal coliform decreased from 179 cfu/100 mL to 146 cfu/100 mL, however, the 90th percentile value increased from 270 to 485 cfu/100mL (Sargeant and Svrjcek 2008). A 64% reduction in 90th percentile fecal coliform levels is needed during the critical period to meet water quality standards (Sargeant and Svrjcek 2008). While the Creek violates the state temperature standards during the critical period, it is generally several degrees cooler than

the mainstem Snoqualmie River (King County 2016). King County (2009) cites fertilizers, septic systems, denuded riparian areas, direct livestock access to the stream, and other agricultural related impacts as potential sources of contamination and water quality degradation.

Griffin Creek has good water quality relative to other tributaries in the lower watershed, but there is not as much water quality data available on the tributary. Griffin Creek has historically exceeded water quality standards for fecal coliform and King County hypothesizes that a combination of anthropogenic sources and wildlife likely contribute to the fecal coliform violations. Fecal coliform levels in Griffin Creek decreased from 212 cfu/100 mL to 77 cfu/100 mL between the 1989-1991 TMDL study and the 2003-05 Effectiveness Monitoring Study. At that time Griffin Creek met water quality standards during the wet season, but did not meet water quality standards for fecal coliform bacteria during the critical period (Sargeant and Svrjcek 2008). A 43% reduction in fecal coliform is needed during the critical period to meet water quality standards (Sargeant and Svrjcek 2008). Water quality standards were met for temperature, dissolved oxygen, and pH based on a 2005 intensity monitoring survey (Sargeant and Svrjcek 2008). Griffin Creek is a basin of concern for temperature, with seven-day average of the daily maximum temperatures (7-DADMax) standards exceeded in the late summer. While the Creek has violated the state temperature standards, it is generally several degrees cooler than the mainstem Snoqualmie River (King County 2016). King County scientists suspect that temperature issues are related to broad open water wetlands in certain areas of the creek, poor stream shading in some reaches, and forestry practices (King County 2009).

3.3.4.7 Physical Habitat Conditions

King County performed qualitative habitat surveys of the entire planning area from 1999-2002 to inventory the state of the physical habitat of the Snoqualmie River and several of its larger tributaries. Good scores indicate a combination of features of high quality habitat, including mature/dense riparian vegetation, mostly native riparian plant species, abundant large wood, channels not confined by levees, little or no revetments or bank erosion, water temperatures within ideal range for salmonid rearing, absence of barriers to fish passage, and presence of salmon and other aquatics species frequently found in healthy streams. Conversely, poor scores are based off a combination of inverse habitat conditions and lack of salmonids and other aquatic species associated with good water quality (Solomon and Boles, 2004).

1. Snoqualmie River

On the mainstem Snoqualmie River, Solomon and Boles (2002) observed conditions worse than in the tributaries. In general, the Snoqualmie River has relatively low amounts of large wood, with most of the wood observed appearing older as opposed to newer recruitments from riparian areas. While wood levels are low compared to what would be expected with more intact riparian areas, they observed a relatively high amount of wood between river miles 24.5-27, a patch just upstream of the confluence with the Tolt River where the river had been laterally migrating since a large avulsion in 1996. The Snohomish Basin Salmonid Recovery Technical Committee (2004) categorizes the Snoqualmie River large wood as

degraded. Large wood is important in streams because it helps form scour pools, provides cover, and increases habitat complexity and volume (Solomon and Boles, 2002).

Bank hardening affects a significant area of reach shoreline, restricting channel width and altering velocity, depth, slope and roughness which all reduce the river's ability to laterally migrate. Physical habitat quality, volume and connectivity are limited by bank hardening in the Snoqualmie River. With bank hardening, the bank cannot migrate and create salmonid winter/high velocity refuge and summer rearing habitats. Bank hardening also restricts fish access to off channel and side channel habitats that provide lower velocity habitats important for young of the year. Bank hardening also reduces undercut banks, limiting key gravel inputs from natural erosion (Solomon and Boles, 2002).

Physical habitat parameters associated with riparian vegetation, like shade, overhanging cover, large wood recruitment, allochthonous material, and prey habitat, are limited in the Snoqualmie River. Solomon and Boles (2002) report that mature trees are present in only 1.8% of left bank river miles and 9% of right bank river miles along the entire mainstem Snoqualmie River.

Solomon and Boles (2002) observed many large pools in the mainstem planning reach. They determined that all but a few pools formed by scour along banks. No large pools were formed by large wood jams.

2. Griffin Creek

In the late 1990s much of this study reach of Griffin Creek had a large stream restoration project occur that realigned portions of the creek channel, added large wood, and planted modest buffers (30 to 80 feet wide) on each side of the creek. Moderate portions of the initial riparian planting near the banks of the creek failed and need further restoration. Due to landowner willingness issues, the bulk of the restoration was focused primarily from river mile 0.4 to river mile 0.7.

Even with the restoration project noted above, Solomon and Boles (2004) classified the first 0.7 miles of Griffin Creek from the confluence with the Snoqualmie River as poor, citing a lack of riparian vegetation and large wood as major issues. The scientists classified the remaining reach that extends beyond the SVAPD boundary as good, observing mostly dense native riparian vegetation, pools, and gravel and cobble substrate.

These evaluations corroborate the findings of the Snohomish Basin Salmonid Recovery Technical Committee (2004), which classified Griffin Creek salmonid habitat as degraded to moderately degraded due to degraded sediment regime, hydrology, water quality, wetlands/riparian zones/large wood, and channel/shoreline conditions and floodplain connectivity. There are relatively few fish passage barriers in this creek system (Unpublished King County data).

3. Patterson Creek

Solomon and Boles (2004) categorized the entire portion of Patterson Creek in the SVAPD as poor habitat. They identify a lack of riparian vegetation and large wood, plus confined channel width and entrenchment, as major issues in the reach. However, based on a later understanding of the geology of the basin, the lower reach's relatively incised channel appears to be a natural condition and not the result of human induced channelization. Similarly, the Snohomish Basin Salmonid Recovery Technical Committee (2004) classified the creek's salmonid habitat as degraded due to degraded sediment regime, hydrology, water quality, wetlands/riparian zones/large wood, and channel/shoreline conditions and floodplain connectivity. There are many known fish passage barriers within this Creek's watershed (King County unpublished data).

3.3.4.8 Salmonid Species, Population Status and Limiting Factors

Under the Endangered Species Act, the federal government listed chinook salmon as threatened, and coho salmon are a species of concern. The Snoqualmie chinook population is approximately 5.7% of the historic abundance (Snohomish Basin Salmon Recovery Forum 2005). A similar abundance number for coho salmon does not exist because their wide distribution throughout the Snoqualmie watershed makes it difficult to accurately monitor total spawning abundance. However, the abundance of coho in the greater Snohomish basin is high relative to other regional basins (Snohomish Basin Salmon Recovery Forum 2005).

Within the focus reach, chinook salmon spawn primarily in the Snoqualmie River between Patterson Creek and the Raging River. The spawning habitat is limited due to the geology and hydrology of the basin that limits gravel deposition to the area six miles downstream of the Raging River, the primary source of gravel. The remainder of the river bed is naturally composed of mostly coarse sand. The creek beds in the study area are also mostly naturally fine grained, with most of the spawning habitat occurring outside of the SVAPD (Snohomish Basin Salmon Recovery Forum 2005).

Within the Snohomish basin, the primary limiting factor for chinook productivity is a lack of high quality rearing habitat. Much of the rearing habitat has been lost, degraded, or disconnected. Unlike many other populations of fall chinook, high proportions (5% to 30%) of adults return that reared in freshwater for a full year (Snohomish Basin Salmon Recovery Forum 2005). Data are limited on where this juvenile yearling life history type rears within the Snoqualmie basin, but they have been sporadically found in small perennial channels in late summer through the Snoqualmie's floodplain (Unpublished data King County).

Within the Snohomish basin, coho use the Griffin Creek and the Patterson Creek habitat in high and moderate levels, respectively. Coho use tributary habitat for spawning and utilize off-channel habitat like oxbows, side-channels and beaver ponds for rearing (Snohomish Basin Salmon Recovery Forum 2005). While there is very limited coho spawning habitat within the SVAPD, coho juveniles rear in many of the smaller stream/drainage channels

throughout the study area and are one of the most frequently encountered fish during agricultural drainage projects (Lucchetti et al 2014).

3.3.4.9 Key Locations for Salmonids

1. Salmon Plan Focus Reach

The Salmon Plan identifies focus reaches and what actions would contribute to salmon recovery. Within the focus reach of this project, the Salmon Plan identifies one focus reach. The Snoqualmie River (RM 31.2-35) Patterson Creek to Raging River confluences is identified as a core chinook spawning reach. This Salmon Plan focus reach was ranked third by Step 5 of the Ecological Analysis for Salmonid Conservation (EASC) for chinook restoration potential (Snohomish Basin Salmonid Recovery Team Committee 2004). The EASC provided the scientific foundation for the Salmon Plan through compilation and analysis of new and existing ecological information about the Snohomish River basin.

2. Ecosystem Diagnosis and Treatment Reaches

The focus reach of the Snoqualmie River has two Ecosystem Diagnosis and Treatment (EDT) reaches (Snohomish Basin Salmon Conservation Plan 2005). The Salmon Plan identifies the Snoqualmie River from the Raging River to near the mouth of Patterson Creek (Reach 4) as the second reach where restoration work should be focused. Reach 5, from the mouth of Patterson Creek to the mouth of the Tolt River, is identified in the Salmon Plan as the 8th reach in the implementation sequence of importance. There is also one EDT reach that covers Griffin Creek and one EDT reach that covers Patterson Creek.

3.3.5 Current Agriculture Conditions

Most the south SVAPD is in some type of agricultural use. The three dominant farming activities in order of prevalence are: livestock (cattle) grazing and forage production, mixed fruit/vegetable production, and equestrian management. The livestock activities are comprised of a dairy operation and several beef operations. The fruit and vegetable farms grow a diverse crop portfolio and most of the product is direct marketed. Equestrian uses range from operations with a small number of personal horses to larger facilities that provide boarding services. Plans are in development to improve the methods for quantifying specific agricultural uses and update the information.

The focus reach is subject to flooding, but is not as hindered by drainage challenges present in the north portion of the SVAPD, outside the focus reach. Flood impacts and the need for irrigation are two of the primary on-farm factors that affect production and farming activities. Some farms have undertaken habitat restoration projects of varying scales, with the majority involving small width (~35ft) riparian planting.

4.0 REACH-SCALE STRATEGY

4.1 Priority Riparian Areas to Protect

4.1.1 Existing High Quality Buffers

Most existing shrub and tree riparian buffers are protected by the King County CAO/SMP. There are two areas of ambiguity. The first is the treatment of CREP buffers. There is one CREP planting in the focus reach that occurred in approximately 2009 and will soon be approaching the end of its rental agreement. Based on discussions with the FFF stakeholder committee, it is our understanding that KC DPER treats CREP buffers as an agricultural practice and those areas can be cleared after the rental contract is completed, generally in 10 to 15 years. However, there is no written King County policy on the topic and there is no formal guidance regarding a timeframe after completion of the rental contract when CREP buffers can be cleared. For instance, under King County policy it is unclear if a CREP buffer that has remained in place for many years after the contract expired could be cleared in 40 to 50 years when the trees reach a typical age of harvest under forestry practices. Other Puget Sound counties treat CREP buffers as protected under their CAO once they are planted and do not treat them as an agricultural practice that can be cleared for new agricultural activities.

The second area of ambiguity is that there are some areas where the existing riparian buffer is wider than the maximum 165-foot area that is protected by King County regulations. These treed areas are not protected from clearing. A longer-term strategy or policy could be considered to encourage or discourage certain activities in these areas. These larger buffer areas could potentially be converted to agricultural uses to offset losses of active agricultural land elsewhere due to restoration projects, or another protection mechanism could be created to protect these areas from clearing to maintain appropriate buffer widths under future channel migration.

4.1.2 Buffers to be Restored and Protected

As part of an informal agreement with some agricultural members of the FFF committee, King County pursued this grant prior to completion of the FFF process. Part of this informal agreement was that the County would only pursue easements on agricultural lands that were of low to no value to agriculture. Given those informal agreements and the scope of the NEP grant, we are limited to looking at only "low" value agricultural lands, which greatly limits lands to be considered for easements and restoration through this grant program.

4.1.3 Existing Plans/Projects to be Leveraged

There are several potential restoration projects near Fall City that salmon recovery interests hope to undertake in the next ten years. These projects would likely increase channel migration processes/the rate of migration. Therefore, a buffer that is wider than

100 to 150 feet would be worth considering in these areas so that if and when the river migrates into those areas, trees are already present. Temperature data collection in 2015 and 2016 has shown that a one mile reach of the Snoqualmie River upstream and downstream of Griffin Creek appears to be a cold water refugia. Incorporating this new knowledge into this riparian project to preferentially shade the area could leverage the shade provided by riparian plantings to extend the benefits of groundwater inputs further downstream. There are a variety of voluntary riparian restoration projects that have occurred over the last 10 years that were typically planted at less than 50 feet in width. These existing areas could be supplemented or leveraged to create wider, more functional buffers.

4.2 Other Priority Restoration Actions

Potential large scale aquatic habitat restoration projects (e.g. levee setbacks) have been identified by King County in the focus reach. Because this riparian easement project focuses on working in areas with low to no value for agriculture, potential aquatic habitat restoration areas were not combined with the riparian easements. It is expected that as large scale aquatic habitat projects are undertaken, the results of this project’s work to define the best places to do riparian work will be incorporated into selection criteria for those projects.

4.2.1 Other land use BMP priorities

Existing King County farm road policies and practices limit some future riparian restoration opportunities by allowing new, expanded, or hardened farm roads within the CAO riparian buffer area. In many places in the SVAPD, farming activities take place up to the edge of ordinary high water or top of bank. A basic water quality protection BMP that establishes a set width no touch area adjacent to waterways would be beneficial to the focus reach, but does not currently exist.

4.2.2 Restoration Actions to Improve Riparian Area Process, Structure, and Function

The focus of this effort has been around the water quality and aquatic habitat benefits that come from wide riparian buffers. This evaluation did not address wildlife benefits of different buffer widths. Existing riparian literature typically describes significantly larger riparian buffers (300 to 1,000-foot-wide) for restoration attempting to restore wildlife habitat. To address wildlife concerns, connectivity to upland habitats above the floodplain would also need to be evaluated. The logic model evaluation of riparian areas did not differentiate between deciduous or coniferous trees, partly because the data were not readily available and because historic tree data indicated a larger proportion of the trees in the focus reach were deciduous. In the longer term, having a greater diversity of tree species would be beneficial for both aquatic fish habitat as well as wildlife habitat. The project did not evaluate connectivity with wetlands or how wetland restoration would benefit riparian buffer areas. Although they were not evaluated as part of this project, the functions of many smaller streams within the focus reach have been degraded by both

clearing of the riparian area as well as agricultural drainage projects that have moved stream channels and removed instream aquatic habitat. Habitat gains could be made by recreating meanders and providing other habitat improvements to these channels, ideally before investing in restoring the channelized stream's riparian area. We anticipate that these riparian buffers will be evaluated in more detail and depth when King County launches its FFF phase 2, which includes the creation of a buffer task force that will make technical and policy recommendations for the riparian areas associated with smaller streams.

4.3 Priority Agricultural Restoration Actions

4.3.1.1 Ag BMP Priorities

The project intended to include prioritizing agricultural improvement practices. Since the grant application was submitted, the Snoqualmie Valley FFF Advisory Committee completed recommendation work. As a significant portion of that work, the Advisory Committee identified key agricultural restoration actions. Ongoing landowner engagement in this project will seek alignments and additions/changes to the FFF Advisory Committee recommendations. FFF Advisory Committee recommendations will be considered throughout implementation of the Project to ensure actions are consistent and in alignment with the proposed FFF recommendations (See Draft FFF agreement for more information

4.3.1.1 Coincident Agricultural Improvements

Specific coincident agricultural improvements have not been analyzed because it is anticipated that coincident agricultural improvements will be explored in detail based on conditions on case-by-case potential easement area acquisitions. It is anticipated that coincident agricultural improvements may include but will not be limited to fencing, drainage improvements

4.3.1.2 Mitigation Scope

Through the FFF process, recommendations were made to establish a mitigation system to transparently provide advance credit for voluntary buffer and wetland planting projects so that riparian projects were not held up for a potential need for mitigation in the future. Fish interests were clear during the FFF process that this type of system would need to occur predominately with private funding from the farmers as most public and grant dollars are not allowed to be spent on mitigation activities. FFF Action Item Number 24 tasks FFF to "Appoint a group of farm, fish, and regulatory experts to pursue the establishment of a clear advanced mitigation system for projects on the same property, so that a person who undertakes a voluntary planting on their property can get mitigation credit for it some years in the future." The recommendation is designed to create a win-win-win for fish, farm, and flood stakeholders by providing an option to allow and encourage riparian plantings now for farmers that may want to expand in the future but would likely impact critical areas. Buffer plantings are typically required as mitigation for

construction or development activities within a wetland or stream buffer. Many farms have areas on their farms that have great potential as buffer planting areas, but some farmers are not willing to plant these buffers now because of potential mitigation needs in the future. KC DPER has provided credit for past buffer plantings, where funding was eligible, however, farmers remain unclear about how to gain assurance that plantings today will result in future mitigation value.

Farmers are faced with multiple scenarios that have potential to benefit from clear mitigation options. For the purposes of this reach plan, a scope of work was developed to provide the foundation and guidance for a mitigation program that focuses on mitigation credit for riparian buffers. (Appendix B)

5.0 PLANNING APPROACH (METHODS)

5.1 Ecosystem Management Decision Support System (EMDS)

King County partnered with USFS EMDS model developers and KCD to develop a transparent decision space. The USFS developed EMDS as a framework for ecological analysis and planning at a defined geographic scale. The system is well-suited for complex problems that have no ideal or optimum solution. EMDS integrates GIS with logic programming and decision modeling technologies, allowing for a complete and transparent representation of all relevant topics in a problem. Logic models are built in NetWeaver, which evaluates environmental data against logic and criteria to determine the state of the system. Policy aspects of a given problem are handled with decision models in EMDS and the decision models are built in Criterium DecisionPlus software. The decision model uses the summarized outputs from the logic model, along with user-defined management objectives, to prioritize landscape features. King County, USFS, and KCD worked with stakeholders to create three logic models and a decision model to help identify high value riparian restoration areas with little to no impact on farmability.

5.2 Logic Model Basics

Logic models are an important component of EMDS and help answer the question, "What is the state of the system?" Individual logic models are built for discrete topics, like "Riparian Function" or "Farmability," and each model includes sub-topics that help characterize the state of the overall topic in a study area. Sub-topics relate to each other through logical operators and hierarchical ordering, as opposed to a ranking system. Each topic also has an associated proposition that the model scores the GIS data against. For example, the proposition for the overall Farmability may be "Farmability is good." The models use criteria based on scientific literature and subject matter expertise to score the GIS data inputs on how well they satisfy a topic's proposition. This scoring allows for the differentiation of patches or units within the selected study area for each topic. The logical ordering of the sub-topics provides for a calculation of the total score for a given patch or unit's score for the overall topic (e.g. Riparian Function or Farmability).

5.3 Decision Model Basics

Decision models are run after the logic models and answer the general question, "Given the state of the system, what can be done about it?" In the context of the land use challenges in the SVAPD, decision models can help identify the areas that provide high riparian function with minimal impact to the greater farmability of the valley. Decision models transparently identify priority areas through subjective ranking of logic model topics, plus feasibility and efficacy components. The decision models intake data from the efficacy and feasibility topics, plus the logic model results, which are summarized with statistics, so that the data are meaningful at the scale of interest (e.g. buffer segments).

5.4 Methods and Process for Determining Reach-Scale Strategies

King County convened logic model workshops to discuss important topics to be included in each logic model. Dr. Keith Reynolds and Dr. Paul Hessburg, experts in EMDS from the USFS, facilitated the workshops and provided guidance when needed. Representatives of both farming and fish interests discussed important aspects of each respective logic model, with a small number of King County staff participating in both sets of workshops. A decision model workshop and follow-up meetings were held to identify priority areas with high riparian function and minimal impact on farmability.

5.4.1 Riparian Logic Model

The riparian logic model was constructed over a series of workshops in 2015 (prior to NEP grant funding) and 2016. The purpose of the riparian logic model development was to evaluate riparian habitat function within a 100 foot or wider buffer area. The core team included multiple ecologists from King County Water and Land Resources Division (Josh Latterell, Kate MacNeale, Josh Kubo, and Kollin Higgins) as well as Josh Monaghan from KCD, Colin Hume from State of Washington Department of Ecology (WDOE), and Paul Hessburg and Keith Reynolds from USFS. Prior to the riparian workshops, staff compiled an exhaustive list of riparian habitat functions from riparian literature reviews to consider in the riparian logic model development. These included: shade potential, large wood recruitment, stream bank stability, instream cover, invertebrate prey production, source of leaf litter, wildlife habitat, filtering out flood debris, reducing flood velocities, water quality-nutrient uptake, water quality-pollution filter, water quality-sediment filtration, carbon sequestration, and evapotranspiration.

During the workshops, the long list of functions was combined and narrowed down to eight primary topics to consider in the logic model: shade/temperature, large wood recruitment, overhanging cover, allochthonous material (litterfall), filtration, prey habitat, channel bank stability, and wildlife habitat (Figure 2, Table 1). These primary functions were further broken into the main factors that affect or drive the specific function. As the discussion progressed, the group realized that many of the functions described above occur within the first 100 feet of a riparian buffer. Said another way, the overall value of these functions does not change as the riparian buffer gets larger than 100 feet. Since this specific project is focused on targeting riparian easements that are 100 feet wide or wider, six of the functions would not provide any differentiation in the logic model scoring on how to value and prioritize where to put 100 to 150-foot-wide riparian buffers. Therefore, the logic model for this specific project only evaluates the potential for the buffer to generate shade and its ability to recruit large woody material (Figure 3). Topics that are not currently being evaluated are shown in grey in Figure 2. If in the future the County uses the EMDS method to evaluate smaller width riparian buffers or riparian buffers on smaller stream systems, the other six riparian functions and scoring structure will need to be fully developed.

5.4.1.1 Shade

The shade component of the logic model is comprised of five sub-topics: solar aspect, microclimate, effective vegetation height, canopy cover, and channel width. The solar aspect of the bank compared to the centerline of the watercourse being evaluated was calculated every 50 feet following a method and scoring process created by the Muckleshoot Indian Tribe for the Green River (Fox 2013). The solar aspect scoring was broken into a fuzzy argument (curve) with solar aspect records receiving scores along a curvilinear function as shown in Figure 8.

The microclimate factor was based off the Snoqualmie temperature TMDL analyses by WDOE and scored slightly different for the Snoqualmie mainstem than for Griffin and Patterson creeks. For a riparian area to have a potential microclimate temperature benefit, the width of the existing riparian area needed to be 150 feet wide or wider. For the Snoqualmie River, the microclimate potential of each side of the river was evaluated independently because the river itself is so wide that the two sides do not complement one another for this factor. However, for the two creeks, the 150-foot buffer was evaluated ignoring the stream channel itself. Thus, the 150-foot-wide area could be a combination of contiguous and adjacent buffers from both sides of the creek or entirely on one side of the creek.

Effective vegetation height combined tree height with how close the tree was to the bank of the watercourse. The taller the tree canopy, the higher the value/score. However, it was also recognized that not all tall trees within a 150-foot-wide buffer are of equal value when it comes to casting shade over the water. The closer the vegetation was to the bank of the watercourse, the higher the value/score. For example, this approach creates a scoring function such that a 150-foot-tall tree, 100 feet away from the banks of the watercourse was of lower value than a 150-foot-tall tree 5 feet away from the bank of the watercourse.

Canopy cover was calculated with 2014 LIDAR data to give higher value for denser canopy areas. The highest score was for areas with 100% canopy cover, with a linear decrease in value as the percent canopy cover decreased to 0%. It should be noted that most of the high-resolution LIDAR data sets the County has access to for this reach are for leaf off conditions. The 2014 LIDAR flight, the most recent data collected for this area, was collected during leaf off conditions. Thus, the canopy cover generated for the model is based primarily from existing branches for deciduous trees versus actual leaves. While this is not the ideal way to generate canopy cover, there are relatively few coniferous trees within the focus reach compared to deciduous trees. A visual comparison of the data to existing leaf on 2015 aerial photography was completed and it appeared to be a reasonable representation of canopy cover.

5.4.1.2 Large Wood Recruitment

Large wood recruitment was broken into four primary factors that looked at the ability of the bank to erode and the amount of wood that could be recruited. The erosion component evaluated the likelihood of the bank eroding. Higher erosion was assumed to occur in

outside bends of the river that were also unarmored. Inside bends and straightaways were considered to have a lower likelihood of eroding, while any places that had a levee or revetment facility armoring the banks were considered as having the lowest likelihood of eroding.

The amount of wood that could be recruited was broken into two parts. The first component was the width of trees (trees classified as vegetation taller than 15 feet) in any part of the buffer polygon (how polygons were derived is discussed below), with wider treed areas scoring higher. The second part was an evaluation of the amount and quality of the wood present. The quality of the wood to undertake geomorphic change once it falls into a waterway was valued by its Diameter at Breast Height (DBH). Since specific DBH data for trees in the Snoqualmie do not exist, we used a tree height to DBH formula developed from cottonwood trees in the Green River (unpublished data) to estimate DBH based on tree height. Trees with greater DBH have a higher value in the model.

5.4.2 Farmability Logic Model

The farmability logic model team constructed the model over a series of workshops in 2015 (prior to NEP grant funding) and 2016. Paul Hessburg and Keith Reynolds from the USFS led the workshops and Colin Hume from WDOE also attended portions of the workshops. The core team of local farming experts included Josh Monaghan from KCD; King County Water and Land Resources Division (WLRD) staffer Rick Reinlasoder; Doug Collins, a Washington State University Soil Scientist; Cynthia Krass, the Executive Director of the Snoqualmie Valley Preservation Alliance; and Leif Fixen, a Program Manager with American Farmland Trust. County staff, KCD, and farmers previously built a conceptual model for agricultural viability as part of the FFF Advisory Committee. This conceptual model served as the starting place for preliminary farmability modeling work that was drafted in 2015.

Farmability is evaluated across all 5,000 acres of the southern SVAPD, so the farmability logic model team decided to setup two models to evaluate a variety of topics at two different scales. The first scale is evaluated in 25ft by 25ft cell increments and is referred to as the "pixel scale." The pixel scale works well because cells will fit within buffer patches, allowing the comparison of farmability and riparian values and ultimate identification of the best places for riparian buffers. Farmability topics at the pixel scale are nested under three main sub-topics: productivity, low risk to productivity, and limited regulatory sensitivity (i.e. lack of regulations) (Figure 4). Farmability was considered at the individual parcel scale because many issues that affect farms occur at a much larger scale than a 25ft by 25ft pixel. For example, it may not be important that a pixel has a farm pad, but it is valuable for a parcel to have a farm pad. Farmability topics at the parcel scale are nested under four main sub-topics: fine scale farmability summed to parcels (pixel scale model), flood resilience, fully operational parcel, and low cost of culvert and drainage maintenance (Figure 5). The farmability team developed a paper version of the parcel scale model, but the computer version was not built because time and resources required the team to focus on developing the pixel scale model for use in the grant.

During FFF, agricultural representatives met with a limited number of farm stakeholders to determine the relative value of different characteristics for evaluating agricultural productivity on the landscape. The initial hypothesis was that soil type played the greatest role, but feedback from the farm community indicated otherwise. Farmers feel the soil in the valley is uniform and differences in productivity are driven by the growing season, which is loosely defined as the time that weather allows plant growth and accessibility to fields (dry) for planting, management and harvest. The closest surrogate for the growing season was built from a combination of elevation, field drainage, and adequate summer water for crops. Higher land is dry for a larger portion of the year and provides better accessibility. Well drained land ensures that drainage does not limit the months a farmer can work a field. Adequate summer water ensures that the farmer can grow through the summer droughty weather.

Building on the work from the agricultural viability conceptual model and FFF efforts, the agriculture team identified an array of topics important to describing good farmability at the pixel (Figure 4, Table 2) and parcel scales (Figure 5). Many of the topics are shown in a grey color because they did not necessarily apply to this focus reach, grant planning activities, or there were not data that were easily accessible or derived. They are important topics however, and are thus included in the diagrams. The discussion below proceeds with the topics that could be included in the current phase of the pixel scale model (Figure 6).

5.4.2.1 Productivity

The proposition for productivity is, "productivity is good." Productivity is comprised of four sub-topics: drainage, access to water, insolation (amount of direct radiation and shading), and soil capability class. The drainage sub-topic examines how well-drained a pixel is and pixels with the best drainage receive the highest scores. For access to water, cells whose center point intersects an area with a water right receive a full score, while those without a water right receive the lowest score. Solar radiation is a measure of the solar radiation that a cell receives, factoring in shading from terrain, vegetation, buildings, and other obstructions. Cells receiving the highest solar radiation are assigned the highest scores, with a linear decrease in scoring until the lowest solar radiation value earns the lowest score. The final productivity sub-topic, soil capability class, reflects soil properties. The model assigns the best scores to capability class values that are associated with the best soils and the lowest scores for the lowest quality soils. Capability class is rated 1-8 with 1 characterizing the soils with the least limitations for farming and 8 characterizing the soils with the most limitations for farming. Most farmed areas in the focus reach are classified as capability class 3, 4, and 5.

5.4.2.2 Low Risk to Productivity

The proposition for low risk to productivity is "low risk to productivity contributes to good farmability." While the language around the topic is clunky, it is required that all the subtopics of farmability are logically congruent and all can contribute to the overall proposition that "farmability is good." Low risk to productivity is comprised of three sub-topics: low likelihood of bank erosion, and low frequency and duration of flood. The low

likelihood of bank erosion sub-topic examines the potential for bank erosion to affect farmability by considering the pixel's proximity to the bank, whether the pixel is on an inside bend, an outside bend, or straight away of the river or creek, whether the bank is armored, and whether the buffer is forested. The model assigns the best scores for low likelihood of bank erosion to pixels that are > 100 feet from the bank and the lowest scores for pixels that are ≤ 100 feet from the bank and along an unarmored outside bend without a forest buffer. Low frequency and duration of flood is a measure of the depth of a 100-year flood, with areas likely to be inundated to a greater depth scoring the lowest.

5.4.2.3 Limited Regulatory Sensitivity

The proposition for limited regulatory sensitivity is "limited regulatory sensitivity contributes to good farmability." Sub-topics currently in the model include forested wetland, forested buffer, and steep slope. All three of these topics are presented in the model in a similar manner; when a regulation restricts farming due to the presence of a forested wetland, forested buffer or steep slope, the model assigns the lowest score possible. Furthermore, the entire model is structured such that the presence of any of these at the center point of a pixel override the scores of other topics, bringing the entire farmability score to the lowest score possible. Additionally, a roads layer excluded the footprint of mapped road from the analysis causing roads to show as no support for farmability.

5.4.3 Decision Model

The initial decision model workshop occurred on November 16, 2016. Participants included Megan (McNeil) Webb (KC), Kollin Higgins (KC), Joan Lee (KC), Janne Kaje (Snoqualmie Forum), Colin Hume (WDOE), Josh Monaghan (KCD), Cynthia Krass (SVPA), Jamie Glasgow (Wild Fish Conservancy), Scott Powell (SCL & Snohomish Technical Committee), Richard Martin (KC), Cindy Spiry (Snoqualmie Indian Tribe), Keith Reynolds (USFS), Paul Hessburg (USFS), and Brett Randle (KC). The workshop was held prior to the logic model results being available for either logic model. This was advantageous to work through some of the policy priorities before seeing the logic model outputs. Prior to the first decision model workshop, several informal meetings were held with Snoqualmie Forum staff to review the riparian logic model approach and to compile potential policy issues that should be discussed in the workshop. A four-page handout was prepared for the decision model workshop that described the Salmon Plan technical background on riparian restoration and explained the policies and spatially explicit riparian restoration goals of the Salmon Plan (Appendix A).

At the beginning of the workshop, the group established that there was an informal agreement with the agricultural community that the County would only pursue easements on low quality agricultural lands, for the purposes of this project.

The group decided that easement acquisition should focus on areas where the logic models indicate riparian areas with low agricultural value without focusing on artificial boundaries, such as parcels. Once the locations with high riparian value and low

agricultural value are identified, visual analyses will inform the boundaries of the possible easement area, based on land ownership and other factors related to practicality of managing the easement location.

Two other topics were included in the draft decision model (Figure 7), the Salmon Plan's focus reaches and cold water refugia. The Salmon Plan has higher priority 'focus reaches' where restoration and protection actions should be focused due to their relevance to salmon recovery. These areas are typically river reaches with high levels of river processes (e.g. channel migration, gravel deposition) and/or high use by chinook salmon or bull trout. In the project focus reach, there is one six-mile-long Salmon Plan focus reach along the mainstem Snoqualmie River from the Raging River to the outlet of Patterson Creek.

Participants in the decision model workshop discussed and debated whether cold water refugia should be addressed in the decision model. Our understanding of the importance of and the locations of cold water areas has been improving. County staff identified an area of cold water refugia near the mouth of Griffin Creek in multiple sampling efforts (King County 2016). The cold water is likely driven by groundwater inputs.

The current riparian logic model does not address connectivity to adjacent buffer areas. Various stream temperature models indicate filling gaps in existing buffers to create longer, contiguous buffers provide greater overall temperature benefits than a fragmented buffer of the same length. Although participants in the decision model workshop agreed it would be better to have a contiguous buffer, it was determined that creating a mechanism for prioritizing riparian areas that fill the gap between existing buffers within the decision model would be difficult and time consuming within the scope of this grant. Due to these limitations, the group decided to address connectivity through a post process visual analysis of the decision model output to prioritize buffer areas for potential easement acquisition.

Decision model workshop participants discussed several other areas of policy focus, including the question of whether a water quality filter strip (25 to 50-foot-wide) along the banks should count as removing agricultural lands from production. Team members decided that the decision model should be run with three different input scenarios from the agricultural logic model to tease out the effects of the first two pixels on the overall output. These would be 1) run the model evaluating the entire buffer area, 2) run the model not including the first 25 feet, and 3) run the model not evaluating the first 50 feet.

Original (1979 bond fund) FPP easement restrictions were briefly discussed during the decision model workshop. FPP easements may limit whether a riparian easement is allowable on specific farm properties in the focus reach. Given the complexities of this issue, it was not resolvable during this meeting or likely within the timeline of this grant. It was suggested that once the logic and decision model results are known, we can see if any FPP properties are identified as being ideal for a riparian easement. If FPP properties are identified, more detailed discussion would need to occur about FPP easement language.

5.4.4 Riparian Restoration Scenario

King County staff completed a QA/QC process and the USFS staff recommended creating restoration scenarios that would model different potential future conditions. This allows better understanding of the highest priority areas for buffer restoration since the existing condition outputs are relatively uniform and low which makes differentiation difficult.

To consider how to evaluate future restoration conditions, the riparian logic model's components were broken into three main types: physical features not readily changeable by human actions (solar aspect, and channel bend), attributes primarily tied to riparian plants (canopy cover, forested width, and vegetation height), and non-vegetation attributes that can be modified or restored by humans (shoreline armor). Based on the three categories, two restoration scenarios were created that centered on if shoreline armoring was 1) removed/restored with the riparian area or 2) left in place. The assumption for both scenarios was that solar aspect and bend type would remain constant, as represented the current condition output. The components associated with vegetation conditions were rescored assuming that all riparian areas were planted and had 50 years of unimpeded, vigorous and successful growth. The microclimate, canopy cover and forested widths were given maximum scores, while the vegetation height scores were not given the maximum values, but a moderately high value of 100 feet tall. With these assumptions, wood load (DBH back calculated from tree height) and effective vegetation height values could still improve if a longer period was assumed for the model inputs.

5.5 Data and Analysis

A variety of existing and new GIS data were used to evaluate and develop the logic models.

5.5.1 Existing Riparian Data

The riparian logic model topics reference existing data whenever possible. Existing data sets included information on where shoreline armoring exists, where different types of vegetation existed as of 2013, and the solar aspect of the banks of the Snoqualmie River in 50 foot segments. The shoreline armoring data came from two sources. The first source was GIS data that King County previously created that show the levees and revetments that the County maintains. These data were transferred into GIS in the 1990s from hard copy maps, with limited field verification. The second shoreline armoring data set came from boat-based field surveys conducted in 2001 and 2002 as part of baseline data collected for the Salmon Plan. In many places the two data sets agree, but the field-based data set includes shoreline armoring that is not part of the King County inventory and generally more accurately defines the end points of the armoring than the projected paper map data. These two data sets were combined into a newly created stream bank file (new data collected below).

Solar aspect data came from an analysis undertaken during the FFF process. The approach evaluated an existing river center line compared to the banks of the river that are immediately adjacent. The line that is perpendicular to the flow was then evaluated for its

solar aspect. Solar aspects were based on the aspect's ability to provide high levels of shade to the watercourse.

Vegetation lifeform data for the study area came from two data sets created or modified during the FFF process. The first data set was vegetation type along the banks of the Snoqualmie River, initially created by WDOE as part of the temperature TMDL. The vegetation type data set was updated based on 2013 aerial photography and the categories were simplified into five land cover categories (ag, developed, shrubs, trees, and other/water). The stream buffers within the focus reach that were not included in the WDOE vegetation type data set were classified by a KCGIS analyst using the same vegetation categories. This basic vegetation information was later enhanced with height, density, and width data (new data collected below).

5.5.2 Existing Agricultural Data

In general, there is a dearth of fine resolution agricultural data for the SVAPD, so the current farmability model often uses small scale (course resolution) data, or surrogates to represent topics. The County and others are pursuing higher quality data for various topics. There is also hope that the development of a strategic plan for agriculture in King County will involve collection of known landscape phenomena (e.g. poor drainage at a certain location) that may help inform farmability assessments.

The pixel-scale farmability logic model contains data from existing sources or those that were easy for County staff to derive. Data regarding duration of flooding provide an approximation of growing season length. A King County GIS analyst previously derived the flood elevation data from the 2004 Snoqualmie flood study (Northwest Hydraulic Consultants 2006). Access to water is represented with water rights data (WDOE). Drainage class, an attribute in the NRCS Soil Survey data, provides information about how well-drained soils are. We also sourced capability class data, which represent basic suitability of soils for most kinds of field crops, from the NRCS Soil Survey. The data from the soil survey offer poor spatial resolution for modeling exercises at fine scales and is not very current. The farmability logic model also relies on the data used in the riparian logic model for shoreline armoring, which was discussed previously.

5.5.3 New Data Collected or Analyses Conducted

Several new data sets were developed for this project. The focus of this project is looking at where to acquire riparian easements, so a new shoreline bank edge was created at a relatively fine scale so that 100 foot and 150 foot buffers would be accurately represented. This was done by editing an existing double bank stream line file while viewing 2015 aerial photography and looking at areas where some form of existing vegetation was growing. Gravel bars and islands (vegetated or not) were not considered to be within the riparian buffer and were waterward of the approximate vegetation line.

Solar insolation quantifies whether there are differences in light available for plant production within the project reach based on existing topography and trees. The data were

generated in ArcGIS with the Solar Analyst tool using first return LIDAR data. A GIS data set was created to help define treed areas within the study area that are protected from clearing/disturbance by regulations or ownership (ie. property owned by King County). This data set was created by WLRD staff by comparing existing GIS data (landslide hazards, steep slope hazards, 165ft stream buffers, wetlands, public ownership) to visibly forested areas on a 2015 aerial image. Polygons were then hand drawn around all protected forested areas that did not appear to have existing agricultural activities occurring within the forested area. The greatest uncertainty for this data set is around forested wetlands. These data likely underrepresent the extent of forested wetlands and their buffers.

The analyses around the likelihood of river bank erosion combined data from several data sets and were used differently in the two logic models. Data describing the channel geometry (inside bend, outside bend, and straightaway) were created with the expectation that outside bends would generally be subject to more erosion than the other two types. For the riparian logic model, unarmored outside bends with trees was considered the best condition because of higher likelihood of recruiting new large wood to the aquatic system. In the farmability logic model, erosion was generally seen as a negative, thus areas that experienced lower erosion rates or aspects that slowed the rate of erosion were considered positive. The farmability model ranged from the least likely to erode (inside bend with armor and trees) to the most likely to erode (unarmored outside bend with no trees).

A County ecologist generated microclimate data by visually evaluating 2015 aerial photography and LIDAR generated canopy cover and tree height data to look for contiguous areas of semi mature to mature treed areas (>50ft tall). If the area of trees was at least 150 feet wide, the assessment polygon was scored as having a microclimate benefit. If the evaluation showed the existing assessment polygon was not uniform in treed condition, the polygon was split into like condition pieces and scored appropriately.

Existing high resolution LIDAR data from the City of Seattle 2014 that covered the entire focus reach were used to generate two canopy cover and vegetation height data sets. It should be noted that the LIDAR flight was undertaken during leaf off conditions to generate the highest accuracy for ground surfaces, creating some potential inaccuracies in these two secondary data sets that focus on vegetative condition. However, once the data were derived, they were compared to known sites by King County staff and they are believed to fairly represent both tree height and canopy cover. Vegetation height was generated by subtracting the high hit return data from the surface return data. Canopy cover was created by comparing the number of LIDAR pulses that were bounced back by tree canopy (taller than 15ft) versus from the ground within a 9ft by 9ft grid area.

A data set for forested areas that are not allowed to be cleared for new agricultural activities based on current regulations was created by using existing GIS data on riparian shrubs and trees, stream locations, wetlands, steep slopes, landslide hazard areas, public lands/natural areas and 2015 aerial photography. Using existing stream riparian vegetation data as the starting point, treed areas in other critical areas were added to the data set based on visual analysis of those other critical areas within the focus reach.

To evaluate the riparian area in the logic model, a 150-foot-wide riparian buffer polygon was generated in GIS using the stream bank line file previously created. The larger polygons were then split into smaller polygons of uniform attributes. This was done in several ways. First the solar aspect, armoring and geomorphic (inside/outside bend) attributes were used to automatically split the polygons into smaller pieces of uniform data. The polygons were then visually inspected and manually split further based on creating polygons of uniform forested width, canopy cover, microclimate and tree height. The polygons were then attributed with the all the GIS data necessary to run the NetWeaver logic model scoring software.

5.6 Key Stakeholder Review and Outreach

5.6.1 Riparian Outreach

Outreach to riparian practitioners was incorporated into the project, but less emphasis was placed on riparian outreach because of the multitude of planning documents that identify priorities for preservation, enhancement, and restoration within the focus reach. Initial meetings were held with King County WLRD staff and Snoqualmie Watershed Forum staff to brainstorm topic ideas and identify data sources to be included in the logic model. Further outreach was done through decision model workshops and most recently presenting the approach to the WRIA 7 Technical Committee.

5.6.2 Agricultural Outreach

Agricultural outreach began early in the project. KCD and King County gave presentations to the King Conservation District Board, the Snoqualmie Valley Watershed Improvement District, and the King County Agriculture Commission in July 2016. These presentations briefed key agricultural stakeholders on how the Snoqualmie Valley APD Riparian Restoration and Ag Partnership Building Project builds on the FFF work. The project deliverables were identified and each group was informed of the need for stakeholder input on the logic and decision models.

In November 2016, the farmability team made presentations to the Snoqualmie Valley Preservation Alliance Board and the King County Agricultural Commission. These meetings were used to begin recruiting stakeholders to participate in the outreach/consultation workshops. Josh Monaghan gave an in-depth presentation on the project and the farmability model to KCD internal staff (15 present) and received both positive and valuable constructive input. Many saw the value for the project both for the NEP grant and beyond for agricultural strategic planning.

Cynthia Krass (SVPA) and Josh Monaghan (KCD) co-led the outreach/consultation phase. They identified key stakeholders and requested participation in EMDS model review workshops.

5.6.2.1 Farmer Focus Groups

In December and early January, two small consultation meetings were held with one to three farmers to introduce the model and review the farmability logic model with agricultural stakeholders. This workshop was designed to familiarize the agricultural community in the SVAPD with EMDS and generate feedback regarding the accuracy of the farmability logic model. The farmability logic model was revised based on stakeholder feedback and farmer input.

On January 20th, a 3 ½ hour focus group with six farmers was held, where the overall project was reviewed and the group dug into the details of the model. At that time, the logic model was still missing some key model elements, so the farmers were not able to see all the working parts.

All the farmers who attended the January 20th focus group showed real interest in the model and asked to stay involved in future meetings. During that meeting, the farmers identified the following missing data that they felt would be important to a fully functional model:

1. Risk data for farm fields impacted by beavers, for farm fields at risk to field scour, and farm fields at risk from impacts from flow changes associated with neighboring planting projects.
2. Concerns about precision of soil survey data for drainage and depth to water table.

Feedback from this focus group was provided to the modeling team, who worked to revise the farmability logic model with existing data and identify how missing priority data might be obtained.

On February 17th, a second farmer focus group was held. Four of the original six farmers were available to attend. In this meeting, the full farmability logic model was analyzed and each of the existing data elements was viewed separately. In the second part of this workshop, Kollin Higgins introduced the riparian logic model to the farmer group and led a discussion with the farmers about the importance of both shade and large wood contribution from large buffers.

In the farmer group review of the draft farmability logic model results, the group reviewed some of the model changes that had resulted from their recommendations. At the workshop, it was identified that several sections of the model data were not performing accurately, so the results were not following the intended model logic. The farmability model staff team committed to working on these and bringing them back with some additional edits at a future meeting. The group reaffirmed their interest in staying engaged in this work going forward and the need for additional data elements. Some the recommended changes to the model from this workshop were:

1. Change the soils data to use the capability classification instead of farmland classification
2. Correct the way the bank erosion element performs in the model

3. Adjust the access to water so that lack of water right did not equal fully failing score for water

At the February 17th meeting with the farmers to evaluate the farmability logic model, it became clear that it was unlikely that the farmability logic model would accurately represent existing conditions that the farming community could agree with within the timeline of this grant. The farmability modeling work shows great promise for the future and has been extremely valuable as a tool to engage the farming community however, more data, that is currently not available, is needed to complete the farmability logic model. Without an accurate farmability logic model, the decision model would also not function. This required the project team to create a new method for combining riparian and farmability value to identify where to do outreach for the project. The new method was to have the farm group use their on the ground knowledge of the study reach to help identify areas with low to no farmability. This was done by having the riparian interests bring their highest priority areas, based on the riparian logic model, on poster sized maps to a new meeting and asking the farmers to draw on the hard copy maps in a 'sharpie exercise'.

5.6.3 Riparian Priorities

Since the choice was made to use an alternative method for decision making, this provided an opportunity to have the riparian interests meet again to verify how they would suggest assigning priority to different riparian segments.

A workshop was held on March 9th with a smaller group than the initial decision model meeting. Participants included: Perry Falcone and Beth leDoux from the Snoqualmie Watershed Forum, Kurt Nelson (Tulalip Tribes) Scott Powell (SCL & Snohomish Technical Committee), Kollin Higgins (KC), Joan Lee (KC), Colin Hume (WDOE) and Rick Reinlasoder (KC). Cindy Spiry and Matt Baerwalde from the Snoqualmie Tribe and Jamie Glasgow of Wild Fish Conservancy (WFC) were unable to attend, but were consulted the following week via a conference call to see if they agreed with the group's recommendations.

The riparian subgroup met and discussed the strengths and weaknesses of different restoration scenarios and model outputs. The group decided to use the restoration scenario that kept the shoreline armoring in place because it is unlikely that shoreline armoring will be removed as part of a planting only project. The group also did not want to inadvertently send the wrong message to the agricultural group, which has historically been sensitive to issues of erosion of agricultural lands.

The group noted that the lift/change output in some cases indicated very high lift while the maximum potential output showed only moderate long term potential for the same location, which caused some concern. The group looked at several approaches for combining the outputs of both the lift/change and the maximum potential. The group settled on creating an approach that initially prioritizes segments into five main groups by overlaying the very high lift/change category onto the maximum potential outputs. This created the following categories, in priority order:

1. Riparian segments that have both very high potential and very high lift/change
2. Riparian segments that have only very high potential
3. Riparian segments that have high potential and very high lift/change
4. Riparian segments that have only high potential
5. All other riparian segments.

The group decided to simplify the categories into two tiers for use in the sharpie exercise. Categories one and two above became tier 1 and categories three and four became tier 2 (
Figure 27, Figure 28, Figure 29, Figure 30, Figure 31, Figure 32).

In the follow up conference call with a WFC staff member, who was unable to attend the meeting, one new potential prioritization factor was identified that had not previously been considered. WFC suggested adding value for the riparian areas in the model that are near or adjacent to tributary junctions based on scientific literature that shows tributary junctions are more biologically diverse than other areas.

The approach to create tier 1 and tier 2 categories does not include information on temperature refugia areas, Salmon Plan focal reaches or connectivity. These considerations, along with tributary junctions, will be used to help refine the final list of easements if the outreach process creates more demand for easements than can be accommodated with the existing funding amount.

A summary of the tier 1 and tier 2 areas is provided in Table 1. The summary does not show how much land is in active agriculture or is already vegetated, but is intended to demonstrate how many acres were classified as tier 1 or tier 2. It shows that riparian segments in tier 1 amount to approximately 80 acres or 16% of the entire potential 150-foot riparian buffer area within the focus reach. Whereas tier 2 areas account for approximately 250 acres or 52% (Table 1).

Table 1. Summary of Tier 1 and Tier 2 Acres and Percentages

South Snoqualmie APD	Acres	% of Buffer Area	% of APD
Tier 1	**78.13**	**16%**	**2%**
Tier 2	**253.80**	**52%**	**5%**
Tier 1 & Tier 2 Subtotal	**331.93**	**68%**	**6%**
Total 150 ft Buffer Area	**489.00**	**n/a**	**10%**

A breakout of tier 1 and tier 2 areas by Salmon Plan reach is shown in Table 2. As with Table 1, this information shows acres and percentages and does not add context regarding existing current condition (i.e. vegetated, in active agriculture) of the areas. Table 2 shows that if all areas within tier 1 and tier 2 were vegetated, the Salmon Plan's 50 year riparian

goals would only be met in the Patterson Creek system. The remaining reaches would fall short of the 50 year goals of the Salmon plan by 10% to 15%. This summary analysis indicates that some of the areas that were not included in tier 1 and tier 2 should still be considered in the long term for riparian plantings.

Table 2. Summary of Tier 1 and Tier 2 Acres and Percentages by Salmon Plan Reach

	Tier 1 Acres	Tier 2 Acres	Total Tier 1 & Tier 2 Acres	Total 150 ft Buffer Acres	% of Buffer in Tier 1 & Tier 2	Plan Goal	% Short of Goal	% of APD Tier 1 & Tier 2	% of APD
Patterson Creek	18.59	36.58	55.16	74.58	74%	65%	9%	1%	1%
Griffin Creek	13.04	10.52	23.56	36.03	65%	80%	-15%	0%	1%
Focal Reach Mainstem	18.98	93.14	112.13	172.09	65%	80%	-15%	2%	3%
Remaining Mainstem	26.75	110.42	137.17	206.75	66%	75%	-9%	3%	4%
Subtotal									
South APD is 5,142.29 acres									

Comparing tier 1 and tier 2 areas to 2013 land cover of the study area that was created by the FFF effort indicated that 39% of the tier 1 areas are currently in active agricultural use while 45% of the tier 2 areas are in active agricultural use. Of more interest is that the percent of mainstem Snoqualmie tier 1 and tier 2 areas in active agriculture is only 33% compared to the two tributaries which have about 60% of the tier 1 and tier 2 buffer area in active agricultural use.

5.6.4 Sharpie Exercise

On March 27th, the final meeting of the agricultural working group occurred. The following people were in attendance: Kollin Higgins (KC), Rick Reinlasoder (KC), Joan Lee (KC), Josh Monaghan (KCD), Cynthia Krass (SVPA), Paul Hessburg (USFS), Matt Tregoning (farmer), Bobbi Lindemulder (farmer), Siri Erickson-Brown (farmer/ag commission), Nayab Khan (farmer), and Jim Haack (farmer). The primary focus of the meeting was to have the agricultural interests QA/QC the updated draft farmability logic model and if it was still not representing reality, use their on the ground knowledge to help locate areas within the study reach with no or low farmability that are appropriate for outreach related to riparian easements.

By the March 27th meeting the farmer group had done some important work tuning the draft farmability pixel scale logic model. The team noted that the grant funding for this phase of the logic model had come to an end. They all spoke very positively about the potential that this modeling approach offers both to agricultural land planning and to

informing decisions. To that end, the model needs further work. The team identified future tasks for farmability logic model work, including:

1. Add Erosion Risk from Scour to the model. This element is a key risk element that farmers identified as missing. It is also a tool that could be used to assess potential risks from future large plantings that raise concerns about potential off-site erosion impacts. The team identified the tool needed is an unsteady, 2D flow model
2. Evaluate potential inclusion (or exclusion) of risks from Beavers; the team recognize that beavers impact farmability, but some on the team suggest that the influence may not be significantly different across the project area enough to use in the logic model.
3. Test whether to exclude access to water from the model. Some argue that water rights fit better in the decision model landscape and want to see the logic model run without.
4. Update Drainage elements in model after Snoqualmie Valley Watershed Improvement District completes basin-wide drainage assessment. Once completed, some on the team would like to test increasing the impact of drainage on overall model results.
5. Add field slope to model. Farmers noted that fields over a certain slope are not as farmable and this element was currently missing from the model.
6. Once slope is included in the model, the some on the team recommended relooking at the role of flood elevation in the model. Most said this is currently overvalued.

Throughout this project, the farmability logic model made significant strides. It became clear to the farmer stakeholder group that the model held great promise for future use in decision-making and agricultural planning, but that in its current state, it was still not complete enough to be solely relied on for decision making within the timeline for this grant project.

As part of the meeting, Kollin Higgins gave an overview of the riparian model and the tiered areas prioritized by the riparian group. Once the group completed review of the state of the draft logic model, maps were laid out on the table and together, the group looked at large poster sized maps of the reach to look for areas where, independent of the working model, they could be comfortable noting riparian areas that would likely have little to no impact to farmability. These spots were then noted for possible marketing of the riparian easement program.

Following the meeting, a draft summary map was developed of the riparian easement spots that were noted as likely minimum to no farmability impact. The map was shared with the farmer group.

5.7 Gaps in strategy

There are several gaps in the existing approach. This project does not address the numerous smaller streams in the study area. These smaller streams were intentionally left out of the analysis to reduce the likely conflict of suggesting large riparian buffers on smaller streams or highly degraded small stream channels. A strategy to address the riparian needs in those areas is still needed. Many of these streams also serve as drainage channels on agricultural properties. A riparian strategy in these areas needs to incorporate a long-term vision for how drainage maintenance activities will occur and how to design riparian areas that can accommodate such activities. Given the informal agreement to pursue only easements on low value agricultural lands until a formal FFF agreement is in place, there are many high priority riparian areas that are also highly degraded and still need to have significant enhancement and improvement. It is expected that King County will create an implementation plan for improving riparian habitats on these smaller tributaries in Phase 2 of FFF, under the riparian buffer task force.

The current strategy did not address how to deal with wide riparian plantings on properties with existing FPP Deed and Agreements (Deeds), primarily those purchased with 1979 Bond dollars. In most cases FPP Deeds were purchased with funds from a 1979 voter approved bond to protect farmland in the Snoqualmie APD and throughout King County. These Deeds restrict activities that would impair the agricultural capabilities of the property. King County's interpretation of FPP Deed limitations will continue to limit the ability of the County and the WRIA to meet its riparian restoration targets on lands protected by these Deeds. It is likely that trying to undertake wider riparian buffers on properties with FPP easements must be evaluated on a case by case basis.

The project also encountered challenges obtaining key data, especially related to agriculture. The soil survey provides the foundation for the farmability logic models, but these data lack the resolution that is needed for reliable analysis of a 25 foot x 25-foot pixel. Better data resolution will need to be achieved either with systematic data gathering or through project by project evaluation. The current data will be useful as an initial assessment, but follow up work may be required to better evaluate a potential project. Drainage data are rooted in the soil classifications, which does not account for the presence or function of drainage systems or changes in the landscape since the soil survey was completed in the 1970s. Field scour risk is a priority for many farmers in the focus reach; however, data were not available to quantify field scour risk in the farmability logic model. It may be important to work to establish an assessment of "Low Likelihood for Field Scour" in future revisions to the models. The parcel scale farmability logic model needs to be further analyzed for structure and associated data inputs.

The likelihood of impacts from beaver activity is difficult to predict with existing data, given most of the topography of the SVAPD is very flat and a beaver dam could potentially be built anywhere along a stream channel with vegetation. Therefore, we decided not to include this topic in the current version of the farmability logic model. However, beaver activity is an important factor identified by the farming community that should be considered when assessing farmability. Farmer and stakeholder outreach will further

define the issues surrounding beaver activity and it will be determined whether there are sufficient data available to analyze the likelihood of impacts from beaver activity in future revisions to the model.

6.0 RESULTS

Results discussed below are preliminary scores from the first working iterations of the models. They are expected to change as scoring, logic, and other factors are refined.

6.1 Riparian Logic Model Results

Riparian logic model results indicate that riparian function in the south SVAPD is very poor (Figure 9, Figure 10, Figure 11, Figure 12, Figure 13, Figure 14). Riparian function results, the cumulative of all sub-topics in the riparian logic model, are skewed heavily towards the very low end of support for the proposition that riparian function is high. Large wood recruitment scores are skewed towards very low support for the proposition that large wood recruitment is high. Support for the proposition of good shade/temperature is skewed towards very low. However, there is a significant reduction in very low scores among large tributary segments, with an increase in moderate values.

The model was QA/QC'd based on known sites in the study area. Staff noted a few minor scoring discrepancies that were modified to improve the accuracy of the erosion component of the large wood recruitment portion of the riparian model. The model indicated that most of the study area has moderate to low functioning riparian areas at this time. This was the case even in some areas that staff initially thought would score much higher. As staff evaluated the various levels of the slightly revised logic model, it became clear that the model's scoring was much more accurate than staff's perception about the riparian quality of some of our existing and older riparian areas.

Much of the lower scores are driven by both historic land clearing practices, high levels of shoreline armoring, and most of the areas of existing vegetation are not yet fully mature, thus their existing function scores are lower than their potential.

6.1.1 Restored Riparian Scenario Results

The two riparian restoration scenarios were then modeled. The primary difference between the two outputs is that keeping the existing shoreline armoring reduced the large wood recruitment scores slightly. The difference was typically such that the total riparian value was reduced by one category (i.e. very high to high or high to moderate) between the two scenarios. In the following sections, this output was considered 'maximum potential' of the restoration scenarios, though it is not quite the true maximum potential that would occur over 100 or more years (Figure 15, Figure 16, Figure 17, Figure 18, Figure 19, Figure 20). This output primarily shows the potential of a site and does not help differentiate how much lift or change a specific riparian segment would undergo through restoration. It also does not aid in identifying riparian segments that are mostly functioning and would benefit from some form of protection, though the current condition model output can provide that distinction.

USFS staff suggested that the current condition output values be subtracted from the restoration model output values to create a change or lift output for the restoration scenarios. This provided a second way to potentially evaluate and prioritize what riparian areas to consider for the easement program. The lift/change outputs show roughly how much improvement is possible, and which areas could potentially have the greatest ecological lift. This approach also clearly identifies areas that are mostly functioning under current conditions that would benefit from additional protection.

Given that the logic model results indicate very low riparian function throughout the reach, we ran a scenario that calculates riparian values as if the 150-foot riparian buffer was reforested and allowed to mature over a 50-year timeframe. Keith Reynolds (USFS) recommended creating this scenario and using it in the decision model to represent potential riparian function instead of using the existing condition logic model results. This shift in approach allows for the comparison of potential function and actual functional lift that we would expect from a full and successful implementation of easement acquisition and replanting. We used the following hypothetical values for all buffer segments:

Table 3. Buffer Segment Hypothetical Values	
Armor	No change
Solar aspect	No change
Outside bend	No change
Microclimate	Yes
Canopy cover	100
Effective vegetation height	100
Forested width	100
Tree height	100

The results of the restored buffer scenario show much higher support for the proposition that riparian function is good (Figure 15, Figure 16, Figure 17, Figure 18, Figure 19, Figure 20). Similarly, large wood recruitment and shade/temperature support is much higher than the current condition results.

6.2 Farmability Logic Model Results

Results discussed below are preliminary scores from the first working iterations of the farmability logic model. Those familiar with on the ground conditions of the focus reach indicated that the results are not accurate. Results are expected to change as scoring, logic, and other factors are refined. The farmability logic model provides results that are based on the logical ordering laid out in the pixel scale farmability logic model. Initial farmability logic model results indicate that support for farmability is high or very high in most of the focus reach (Figure 21, Figure 22, Figure 23, Figure 24, Figure 25, Figure 26). There is high support for the proposition that productivity is high and support is skewed towards high or very high support for the proposition that risk to productivity is low.

Areas with no support for farmability were largely driven by current regulations that prohibit clearing of forested areas meeting certain criteria such as forested wetlands, forested buffers, and steep slopes. Very high support for farmability appears to be skewed

towards pixels that are located outside of the 100-year floodplain of the Snoqualmie River, indicating under the current farmability logic model a high farmability value is placed on pixels that are less affected by floods.

6.3 Sharpie Exercise Results

The sharpie exercise replaced the decision model that was originally planned to identify priority riparian restoration areas with low or no impact on farmability. Areas of low or no farmability were identified on paper maps with tier 1 and tier 2 riparian easement priorities (
Figure 27, Figure 28, Figure 29, Figure 30, Figure 31, Figure 32). Following the meeting, King County staff translated the paper maps to electronic maps of potential buffer easement areas. Identified potential easement areas are located mostly along the mainstem of the Snoqualmie River and Griffin Creek (Figure 33, Figure 34, Figure 35, Figure 36, Figure 37, Figure 38). No locations of low to no farmability were identified through this process on Patterson Creek.

7.0 STRATEGY AND OPPORTUNITIES

Parcel-scale strategies and specific opportunities to protect or restore buffers were identified through the completion of the sharpie exercise. Although reach planning took longer than originally anticipated, through this project, the team could build relationships with the agricultural community and continue to build trust necessary for future conversations involving this project the larger FFF effort.

7.1 Priority Parcels to Protect or Restore Buffers

With input from farm stakeholders and local landowners riparian areas that were not farmable or had low farmability, based on knowledge of the broader agricultural landscape, were identified. From this exercise, King County staff translated the areas into buffer segments. Buffer segments were identified on 32 parcels, owned by 17 landowners that have potential for riparian buffer easement areas with little to no impact on farmability (Figure 39, Figure 40, Figure 41, Figure 42, Figure 43, Figure 44). Most of these riparian buffer segments were identified as tier 1 or tier 2 riparian areas.

Table 4. Summary of Riparian Area Linear Feet and Acreage

	Linear Feet of Riparian Area	Acres
TOTAL	**25,684**	**81.1**

The current condition of these buffer areas, identified through the EMDS logic model, ranges from very low to moderate and the lift potential ranges from moderate to very high.

7.1.1 Due Diligence

The 32 identified parcels were mapped for further due diligence review. First, landowners were identified. Five identified segments are currently in public ownership by King County, so these parcels will be omitted from further review and outreach. Existing, known easements were added to the map to show which parcels already had a conservation easement of some form. This includes environmental conservation easements, TDR conservation easements, and FPP conservation easements. Although TDR and FPP easements may not preclude riparian planting and protection, parcels with these restrictions will need to be reviewed on a case by case basis. Four parcels (11.9 acres and 3,679 linear feet) currently have FPP easements. These properties will need to be assessed for eligibility on a case by case basis as landowner willingness is determined.

7.1.2 Restoration Opportunities

Identified riparian easement areas hold opportunity for enhancement or restoration through planting, protection from livestock and grazing, and protection from small scale clearing.

Identified areas that have existing vegetation can be improved ecologically over time. Most these sites have only deciduous trees (predominately cottonwood) or are dominated by a combination of native and non-native shrubs. Riparian quality can be improved through species diversity improvements such as underplanting with conifers and removing non-native species such as Himalayan Blackberry and various clematis species. In the long term, plantings will greatly improve and increase the height of vegetation in areas with existing vegetation. The addition of new native vegetation will also improve canopy cover and overall density, further reducing the likelihood of new non-native species becoming established.

Several identified riparian areas have little to no riparian cover. Revegetating these areas would greatly improve existing conditions. One identified area has experienced active lateral channel migration for the last few years. Establishment of a wide buffer may be able to reduce the rate of migration to a more natural rate. Areas identified along Griffin Creek are in an area that had an aquatic and riparian restoration project in the late 1990s. The project was relatively narrow in several places and portions of the planted area failed. Establishment of an easement with the new landowners would allow King County to go back and finish what was started in the 1990s.

Areas were identified with active livestock that may currently have access to riparian areas. Exclusion fencing could be implemented around easement areas to improve long term protection.

Small scale clearing of King County protected CAO riparian buffers happens regularly (Lucchetti CAO report, Higgins 2014, WRIA 9 ITC 2012). Easements provide greater protection against small scale clearing since the easements will be monitored by King County staff into the future. Landowners are less likely to clear into riparian areas when an easement is recorded on title. Placing perpetual easements on riparian buffers provides another layer of protection for riparian areas and reduces the uncertainty of protection since regulations can change and exemptions can be authorized.

7.1.3 Landowner Outreach

The farmability staff team developed a landowner contact list based on the March 27th meeting map work. The King Conservation District sent postcards promoting the easement program and will follow up with an e-mail or phone follow up. Interested landowners will be directed to King County staff to explore the easement program details.

7.1.4 Assessment of Landowner Willingness

Landowner willingness will be evaluated following outreach which includes post cards, email, and phone calls. The project has created farmer community support for the project, an important step towards landowner willingness.

7.1.5 Easement Term Considerations

Easements will be granted to and monitored by King County. Permitted uses will include those that are consistent with the conservation purposes of the easement including but not limited to outdoor recreation, habitat restoration and scientific study. Prohibited uses will include those uses that are inconsistent with the conservation purposes of the easement including but not limited to clearing of vegetation, grading, mining, and most construction of buildings, structures, dikes, or other improvements. Each individual easement will be negotiated with the landowner and the following may be evaluated on a case-by-case basis: coverage, public access, subdivision and development. Other specific easement terms may be negotiated if they can be demonstrated to be consistent with the conservation purposes of the easement and ultimately the function of the riparian zone for maintenance of salmonid habitat and water quality parameters. The duration of the easements is intended to be perpetual and run with the property, applying to all subsequent landowners.

8.0 IMPLEMENTATION

8.1 Next Phase

The next phase of the Project includes finalizing landowner willingness and initiating the acquisition process to acquire easements on riparian areas. Restoration will be implemented where applicable. The Project also informs work on other related efforts and opportunities may be available to expand on the EMDS work, collect needed missing data, and further develop the farmability logic model and EMDS decision model.

8.1.1 Acquisition Process

King County has a clearly defined acquisition process that ensures voluntary transactions are completed on land that is eligible for acquisition or acquisition of an interest in a property, in this case an easement.

8.1.1.1 Confirm Landowner Interest

The landowner(s) must be notified of the County's intent to acquire an interest in their property. It is anticipated that landowner outreach will be complete and landowner willingness will be established at which point the acquisition process will begin.

8.1.1.2 Preliminary Title Commitment

The King County Title & Escrow Officer will request a preliminary title commitment from an outside title company. The title company will provide a title report to the County title & escrow officer that will identify the legal landowner and encumbrances recorded on the property. Upon receipt of the title report, the County title & escrow officer will review the title report for liens, claims to ownership, access, etc. Respective property should obtain a "clear" title free from encumbrances which are not acceptable to King County and the funding source for easement acquisition. Any items impacting title must be cleared prior to closing.

8.1.1.3 Appraisal

An appraisal of the real property to be acquired is an essential required step in the acquisition process to determine the fair market value (just compensation). An appraisal is the process of formulating, supporting and communicating an opinion of value. The appraisal must be prepared and reported in conformance to Uniform Standards of Professional Appraisal Practice (USPAP) by an Ecology Yellow Book certified firm and contain an adequate description of the physical characteristics of the property being appraised (and, in the case of a partial acquisition, an adequate description of the remaining property), including items identified as personal property, a statement of the known and observed encumbrances, if any, title information, location, zoning, access, present use, an analysis of highest and best use, and at least a 10-year sales history of the property. It must also include a description of comparable sales, including a description of

all relevant physical, legal and economic factors. A statement of the value of the real property to be acquired and, for a partial acquisition, a statement of the value of the damages and benefits, if any, to the remaining real property, where appropriate must be included. All relevant and reliable approaches to value consistent with established federal and federally-assisted program appraisal practices must be included.

A qualified review appraiser will review the appraisal in conformance to USPAP, Ecology Yellow Book standards and any additional guidelines or requirements to ensure it meets applicable appraisal definitions and requirements and will, before acceptance, seek necessary corrections or revisions.

8.1.1.4 Extend Offers to Acquire Real Property Interest

The acquisition agent will prepare the real estate documents, which include the offer letter, purchase and sale agreement, real estate routing document, findings of fact report, site maintenance cost estimate and property maps. The real estate documents are forwarded to the Department Director for approval and signature.

The acquisition agent will allow the landowner reasonable opportunity to consider the County's offer, to obtain professional advice, to present material which the owner believes is relevant to determining the value of (or damages to) the property, and to suggest modifications to the terms and conditions of the purchase agreement. The typical timeline associated with accepting the offer or submitting a counteroffer is four weeks.

8.1.2 Related Efforts and Further Development of EMDS Models

Data gaps prevented the current farmability logic model from being fully operational and therefore precluded developing a combined riparian health and farmability decision model within the grant timeline and budget for the Project. Still, the process shows remarkable promise as a transparent and participatory process that agricultural and riparian stakeholders have expressed strong support for further development.

At this writing there are several efforts underway that have the potential to build on the work of this grant—both the identification of priority areas for easement acquisition and development of the EMDS model:

1. The King County Executive has launched an effort to identify a pathway to permanently protect all high conservation value lands across the County in the next 30 years to support long term health of King County residents and the environment. The work of this project may be used to help inform the Land Conservation effort. http://www.kingcounty.gov/services/environment/water-and-land/land-conservation.aspx

2. The near-concluded Phase 1 Snoqualmie Valley Fish Farm Flood Advisory Committee recommendations include the following, all of which refer in some way or could build on the development of the EMDS model to help identify areas for uplift of riparian health with limited or no impact to agriculture or with clarity surrounding impacts that are needed:

   - Creation of a Snoqualmie Valley Agricultural Land Resource Strategic Plan
   - Snoqualmie Valley Buffer Implementation Strategy
   - Agricultural Regulatory Barrier Removal Strategy

Efforts underway in the larger Snohomish watershed (WRIA 7) to address similar issues and provide greater regulatory alignment are also exploring use of the EMDS approach.

By clarifying the data gaps in the farmability logic model (soils, drainage) and increasing understanding between farm and fish communities and interests, the EMDS approach has helped those involved in the issues more sharply articulate what is at stake and provide a more reasoned basis for determining pathways forward whether for fish or farms. Our ongoing thanks to Ecology for providing the opportunity to explore this approach.

9.0 FIGURES

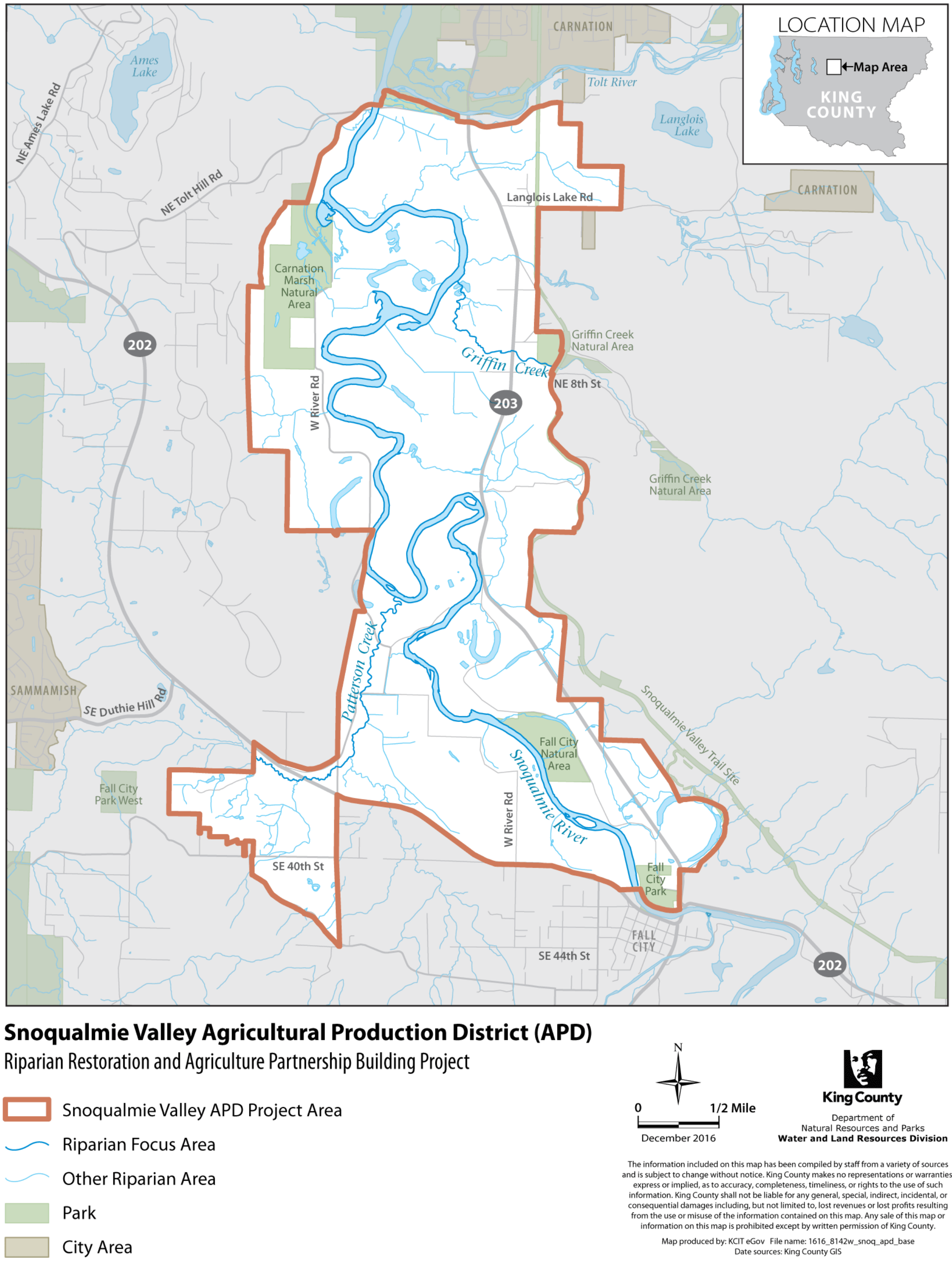

Figure 1. Snoqualmie Valley APD Project Area Map

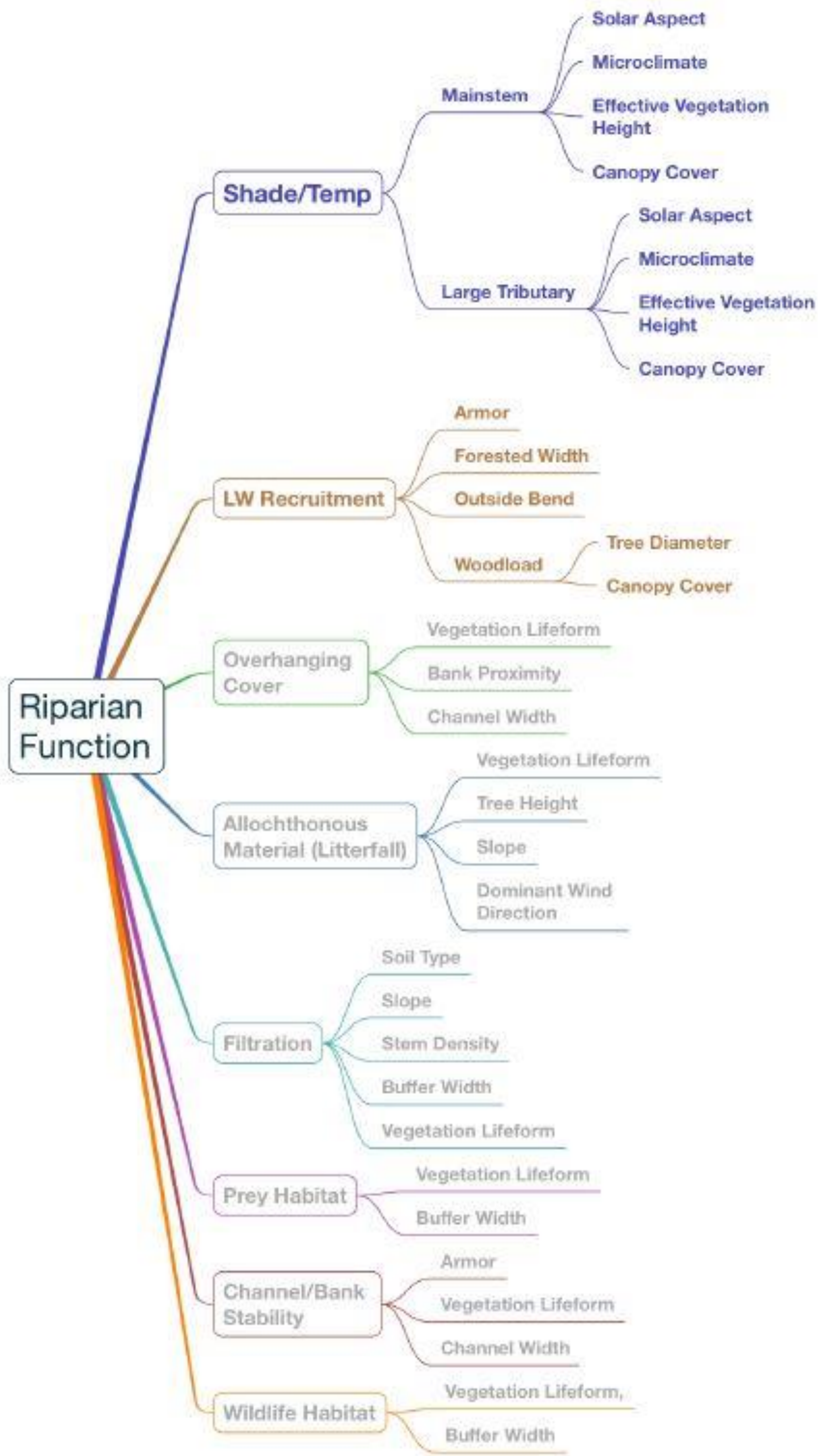

Figure 2. Riparian Function Logic Model Topics

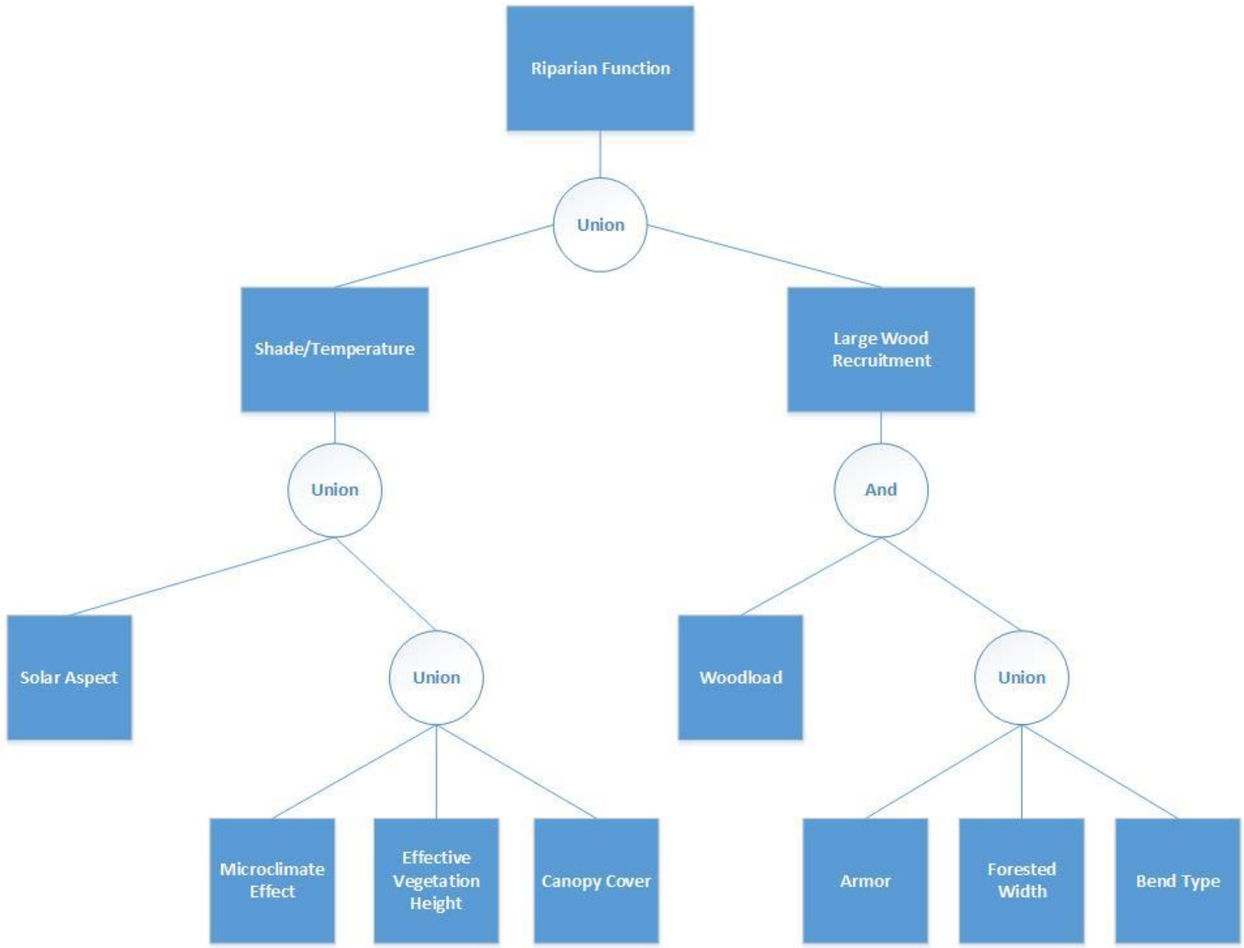

Figure 3. Riparian Logic Model Structure

Table 5. Riparian Topics and Data Sources

Logic outline for evaluation of riparian functional lift at unit scale.

Model topic	Primary topic	Secondary topic	Tertiary topic	Proposition	Data Source	Model Criteria
Riparian Function				Riparian function is good		
	Shade			Good shade supports riparian function		
		Solar Aspect		Solar aspect is an existing physical condition that effects the ability of trees and topography to provide shade	Derived with ArcGIS Solar Analyst	0 = -1, 45 = -1, 90 = -.25, 135 =1, 225 =1, 270 =.25, 315= -1, 360 = -1
		Microclimate		Microclimate effect is present and conducive to good shade	Visual evaluation of bank microhabitat within contiguous 150' wide buffer segments.	Yes = 1 No=-1
		Effective vegetation height		Tall trees near the bank are conducive to good shade	Derived using leaf-off LIDAR data and ArcGIS Near function	0 = -1, 100 =1
		Canopy cover		Dense canopy cover is conducive to good shade	Derived using leaf-off LIDAR data	0 = -1, 100 =1
	Large Wood Recruitment			Large wood recruitment is good for riparian function		
		Armor		The absence of shoreline armoring is conducive to large wood recruitment	Existing County data	No = 1, Yes = -1
		Forested width		Wide forested buffers provide more large wood recruitment	Derived using LIDAR data	0 = -1, 100' or 150' = 1
		Outside Bend		Outside bends are conducive to erosion and large wood recruitment	Derived visually by King County geologist	Yes = 1, No = -1
		Woodload (union)		Good woodload is conducive to large wood recruitment		10 = -1, 40 = 1
			Tree diameter	Large diameter trees are conducive to good woodload	Applied regression function to tree height data from LIDAR to derive DBH	0 = -1, 100 =1
			Canopy cover	Dense canopy cover is conducive to good woodload	Derived using LIDAR data	
	Overhanging cover			*Overhanging Cover is good and supports riparian function*		
		Vegetation lifeform		*Vegetation lifeforms are conducive to overhanging cover*	*N/A*	*N/A*
		Bank proximity		*Near bank proximity is conducive to overhanging cover*	*N/A*	*N/A*
	Allochthonous Material (Litter-Fall)			*Litterfall is good and supports riparian function*		
		Vegetation		*Vegetation lifeforms are conducive to large trib leaf*	*N/A*	*N/A*

		lifeform		*litter-fall*		
		Tree height		*Tall trees are conducive to large trib leaf litter-fall*	*N/A*	*N/A*
		Slope		*Steep slopes are conducive to large trib leaf litter-fall*	*N/A*	*N/A*
		Dominant Wind Direction		*Dominant wind direction is conducive to large trib leaf litter-fall*	*N/A*	*N/A*
	Filtration			*Filtration is good and supports riparian function*		
		Slope		*Slopes is conducive to filtration*	*N/A*	*N/A*
		Soil Type		*Soil type is conducive to filtration*	*N/A*	*N/A*
		Buffer width		*Buffer width is conducive to filtration*	*N/A*	*N/A*
		Vegetation Lifeform		*Vegetation lifeforms are conducive to filtration*	*N/A*	*N/A*
	Prey Habitat			*Prey habitat is good and supports riparian function*		
		Vegetation lifeform		*Vegetation lifeforms are conducive to prey habitat*	*N/A*	*N/A*
		Buffer width		*Buffer width is conducive to filtration*	*N/A*	*N/A*
	Channel/Bank Stability			*Channel/Bank Stability is low and supports riparian function*		
		Armor		*The absence of shoreline armoring is conducive to large wood recruitment*	*N/A*	*N/A*
		Vegetation lifeform		*Vegetation lifeforms are conducive to prey habitat*	*N/A*	*N/A*
		Channel width		*Channel width is good and conducive to channel/bank stability*		
	Wildlife Habitat			*Wildlife Habitat is good and supports riparian function*		
		Vegetation lifeform		*Vegetation lifeforms are conducive to wildlife habitat*	*N/A*	*N/A*
		Buffer width		*Buffer width is conducive to wildlife habitat*	*N/A*	*N/A*

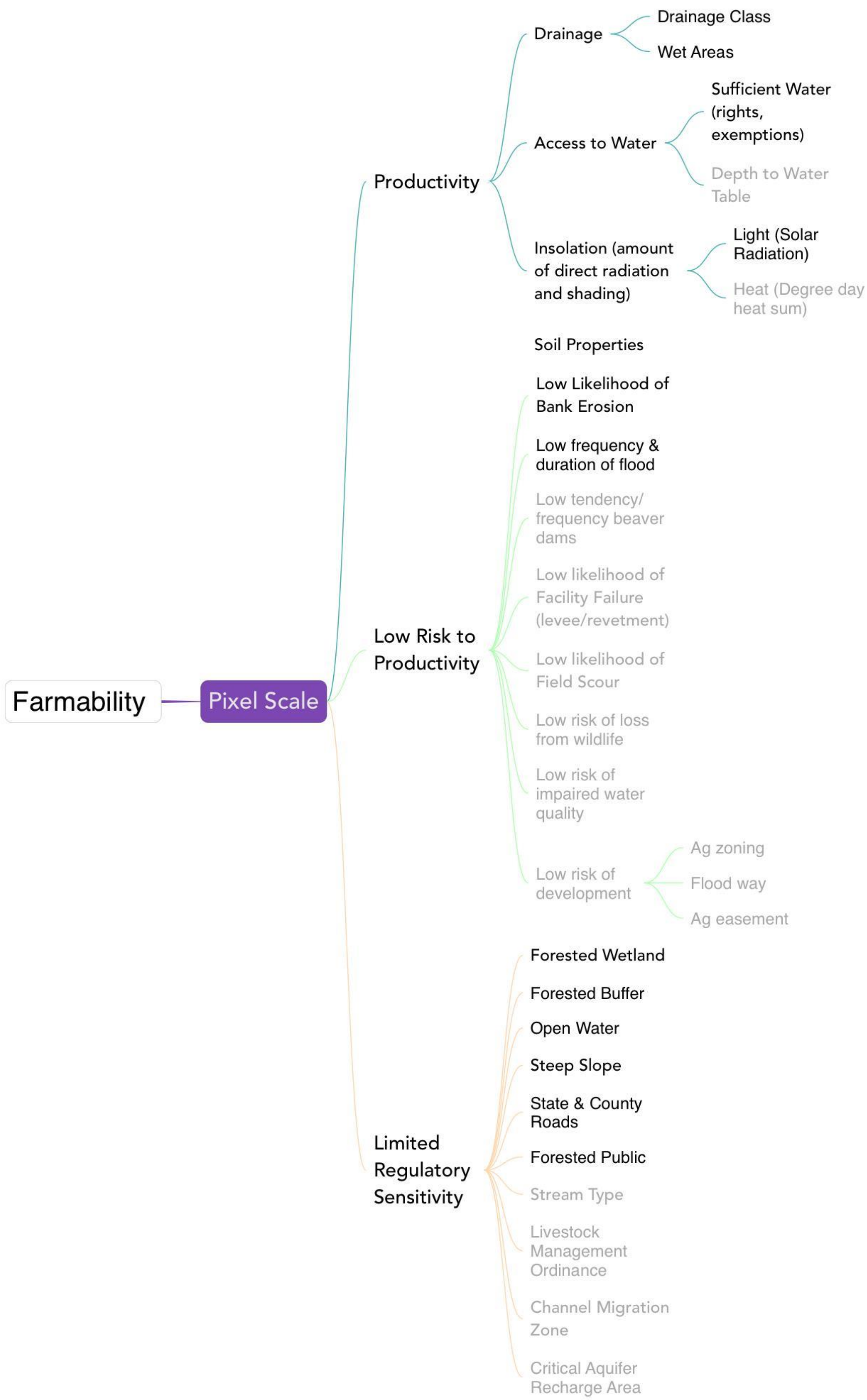

Figure 4. Farmability Pixel Scale Logic Model

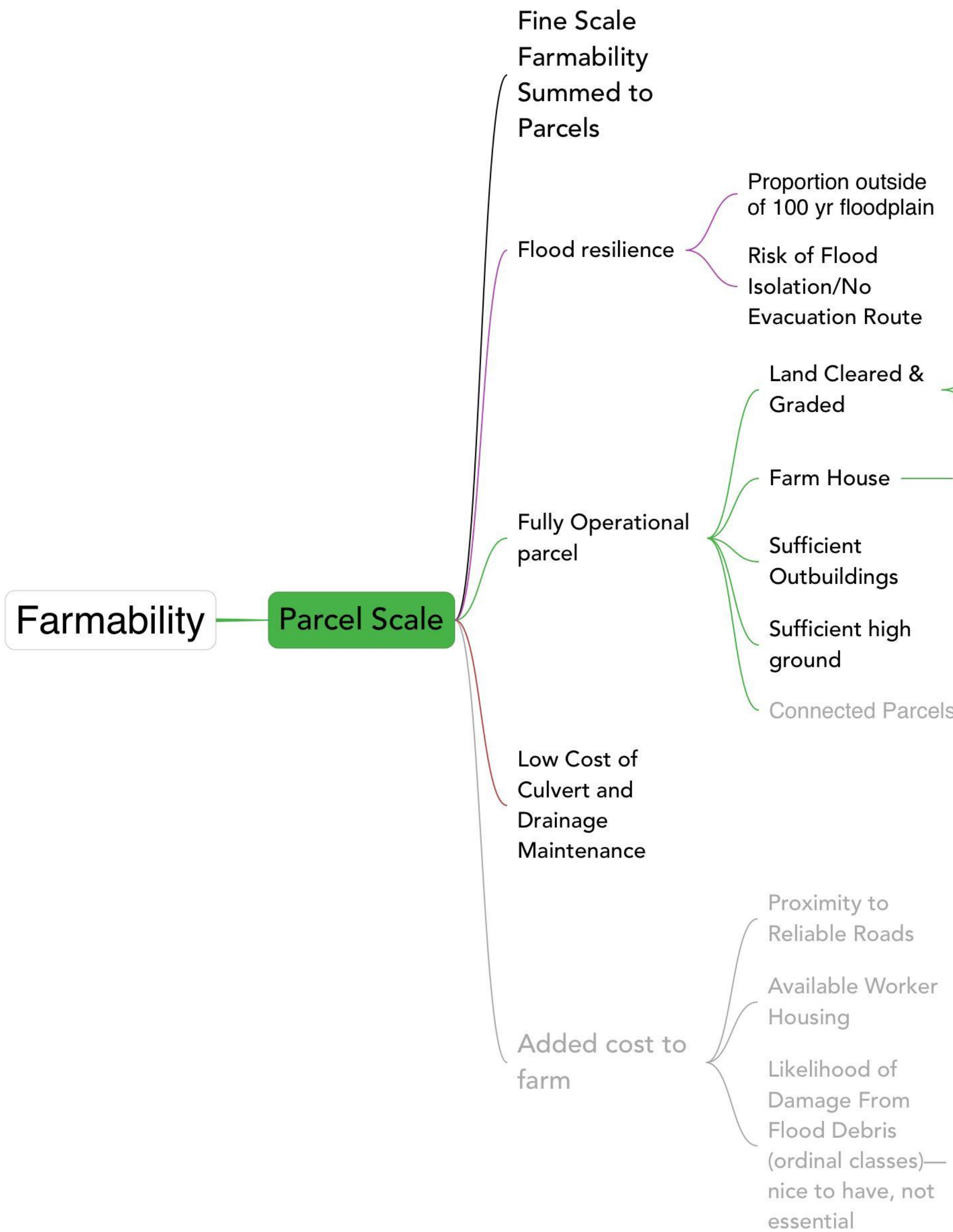

Figure 5. Farmability Parcel Scale Logic Model

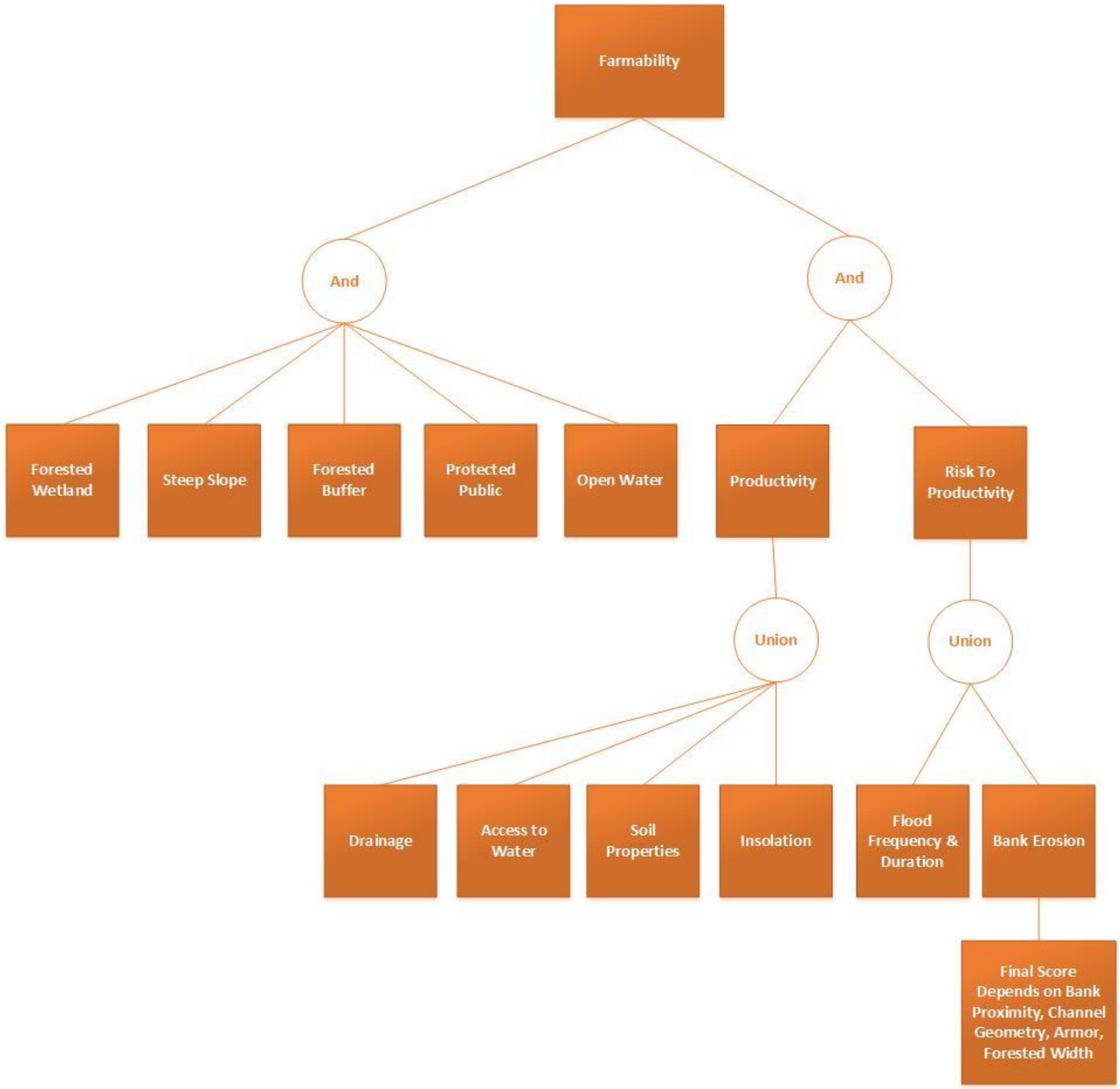

Figure 6. Farmability Pixel Scale Logic Model Structure

Table 6. Farmability Topics and Data Sources

Logic outline for evaluation of farmability at pixel scale.

Model topic	**Primary topic**	**Secondary topic**	**Tertiary topic**	**Proposition**		
Farmability (Pixel)				Farmability is good		
	Productivity			Productivity is good		
		Drainage		Drainage contributes to good productivity	SSURGO	Excessively drained/somewhat excessively/well drained = 1, Moderately well drained = 0.5, Somewhat poorly drained = 0, Poorly drained/very poorly drained = -0.5, Subaqueous = -1
		Access to water		Access to water supports productive potential		
			Sufficient water rights (rights, exemptions)	Water rights contributes to good access to water	Department of Ecology; ftp://www.ecy.wa.gov/wr/GWIS_Data	Yes = 1
			Depth to water table	*Depth to water table contributes to good access to water*	*SSURGO(currently insufficient)*	*90cm = 1, 60cm = 0.5, 0 = -1*
		Insolation (amount of direct radiation and shading)		Insolation supports productive potential		
			Light (Solar radiation)	Light contributes to good solar insolation	Derived with ArcGIS Solar Analyst	1036726 (highest value) = 1, 6075 (lowest value) = -1
			Heat (Degree day heat sum)	*Heat contributes to good solar insolation*	*Unavailable*	*N/A*
		Capability Class		Soil properties contribute to good productivity	SSURGO	1 = 1, 2 = 1, 3=0.75, 4 =0.5, 5=0.25, 6=0, 7=-0.5, 8=-1
	Low Risk of Productivity			Low risk of productivity contributes to good farmability		

		Low likelihood of bank erosion		Low risk of shoreline bank erosion improves certainty	Various input data from King County or derived with Near function in ArcGIS	Bank proximity unknown = Undetermined; Bank proximity >100 = 1; Bank Proximity ≤100, inside bank, armored, forested buffer = 0.9; Bank Proximity ≤100, inside bank, armored, no forested buffer = 0.75; Bank Proximity ≤100, inside bank, not armored, forested buffer = 0.25; Bank Proximity ≤100, inside bank, not armored, no forested buffer = 0; Bank Proximity ≤100, outside bank, armored, forested buffer = 0.25; Bank Proximity ≤100, outside bank, armored, no forested buffer = 0; Bank Proximity ≤100, outside bank, not armored, forested buffer= 100; Bank Proximity ≤100, outside bank, not armored, no forested buffer = -.75;Bank Proximity ≤100, not bank, armored, forested buffer = 5; Bank Proximity ≤100, not bank, armored, no forested buffer = 0.25; Bank Proximity ≤100, not bank, not armored, forested buffer= -.1; Bank Proximity ≤100, not bank, not armored, no forested buffer = -.25;
		Low frequency and duration of flood		Low likelihood of flooding improves productivity	Derived from flood depth data from 2004 floodplain mapping	0 = 1, 8 = 0, 20 =-1
		Low tendency/ frequency of beaver dams		*Low likelihood of beaver dams and associated ponded water improves productivity*	*Derived from LIDAR*	*Yes = -1, No = -1*
		Low likelihood of facility failure (levee/revetmen t)		*Low likelihood of failure reduces risk of bank and farmland erosion*	*N/A*	*N/A*
		Low likelihood of field scour		*Low likelihood of field scour reduces the risk of farmland erosion*	*N/A*	*N/A*
		Low risk of loss from wildlife		*Low likelihood of wildlife reduces the risk of crop loss*	*N/A*	*N/A*
		Low risk of impaired water quality			*N/A*	*N/A*
		Low risk of development				
			Agricultural Zoning		*N/A*	*N/A*
			Floodway		*N/A*	*N/A*
			Agricultural Easement		*N/A*	*N/A*

	Limited Regulatory Sensitivity			Limited regulatory sensitivity contributes to good farmability		
		Forested Wetland		Absence of forested wetlands contributes to good farmability.	Derived visually using various existing King County data	No = 1, Yes = -1
		Forested Buffer		Absence of forested riparian stream buffers contributes to good farmability.	Derived visually using various existing King County data	No = 1, Yes = -1
		Forested Public		Absence of forested public contributes to good farmability.	Derived using various existing King County data	No = 1, Yes = -1
		Steep Slope		Absence of steep slopes contributes to good farmability.	Derived visually using various existing King County data	No = 1, Yes = -1
		Roads		Absence of roads contributes to good farmability.	Derived visually using King County Roads data	No = 1, Yes = -1
		Stream type		*Absence of some stream types contribute to good farmability.*	*N/A*	*N/A*
		Channel migration zone		*Absence of mapped channel migration zones contributes to good farmability*	*N/A*	*N/A*
		CARA (Critical Aquifer Recharge Area)		*Absence of critical aquifer recharge areas contributes to good farmability*	*N/A*	*N/A*
		Livestock Management Zone		*Absence of livestock management zones contributes to good farmability*	*N/A*	*N/A*

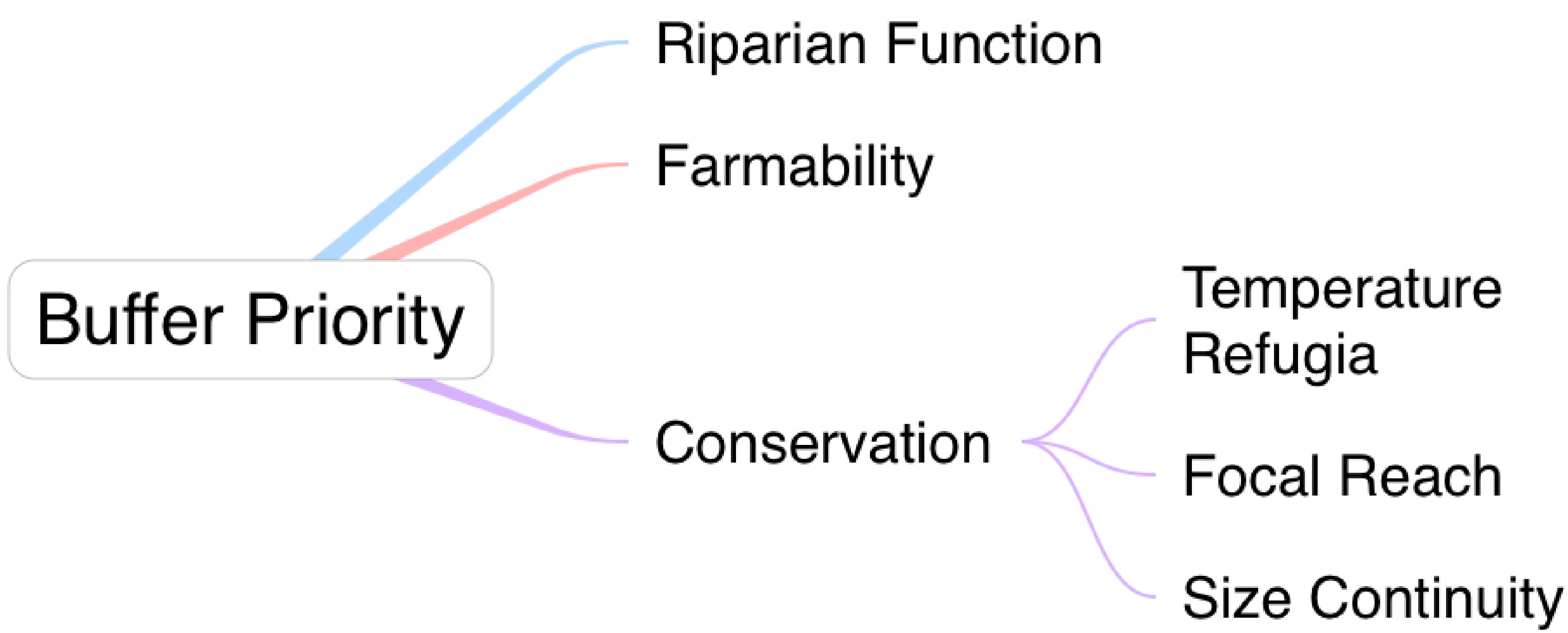

Figure 7. Decision Model

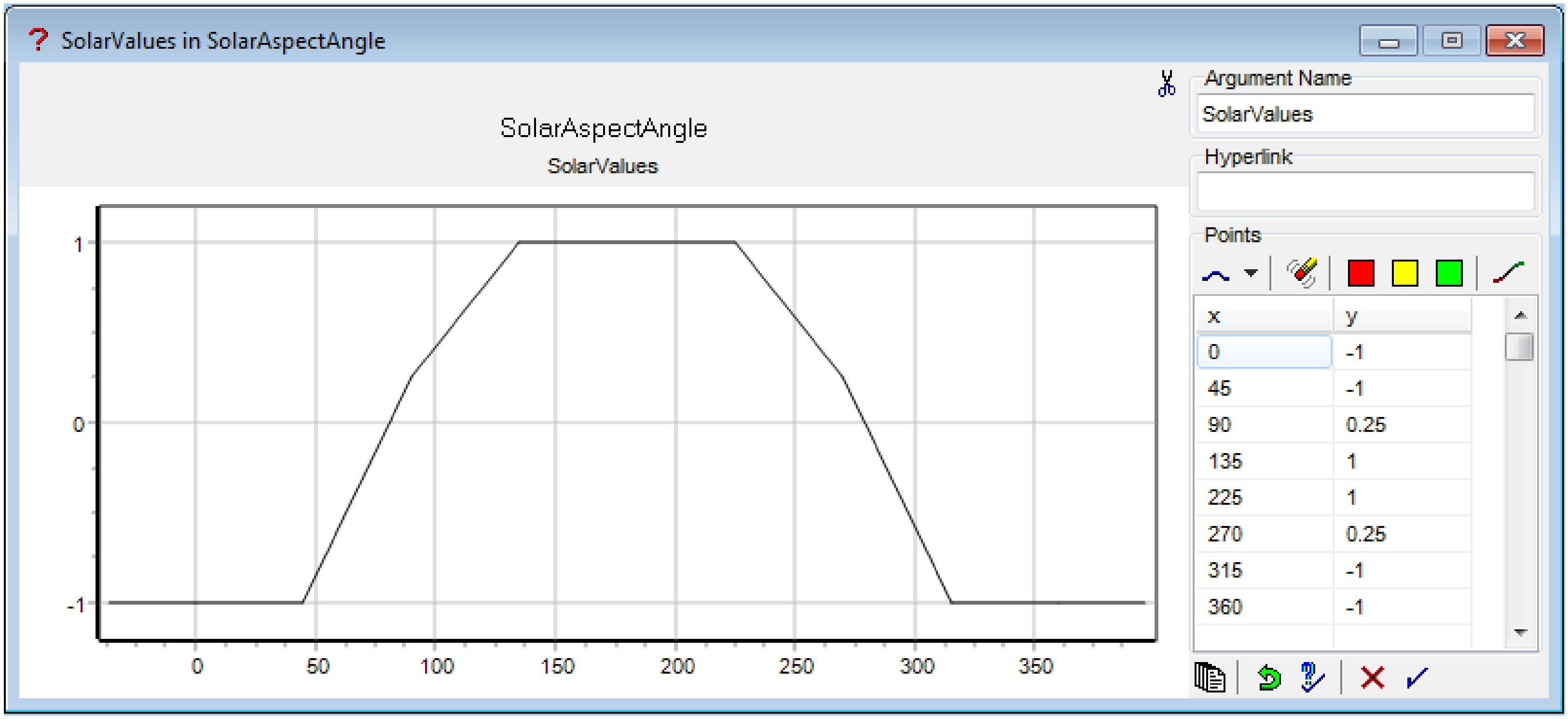

Figure 8. Solar Aspect Fuzzy Logic Scoring

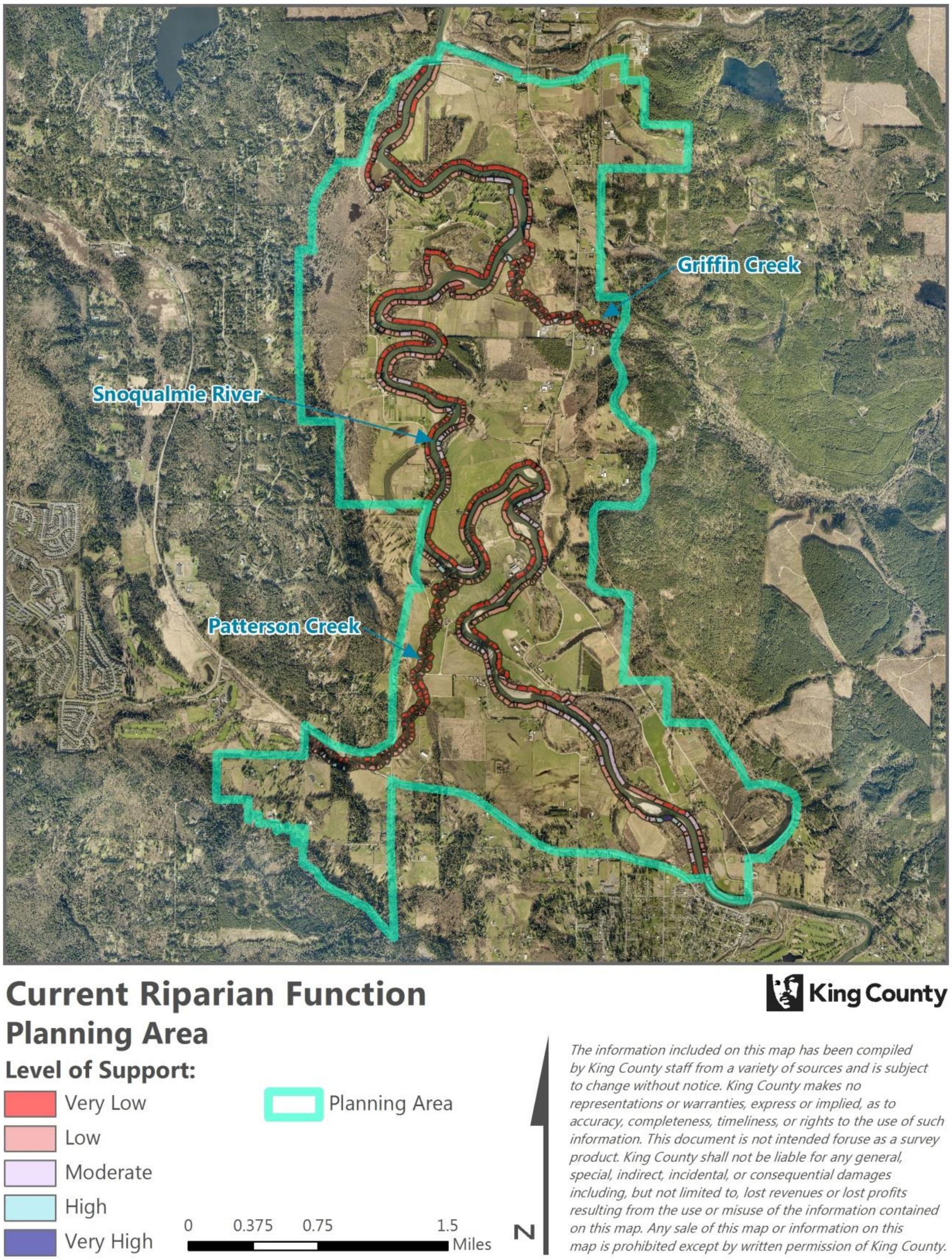

Figure 9. Current Riparian Function (Planning Area)

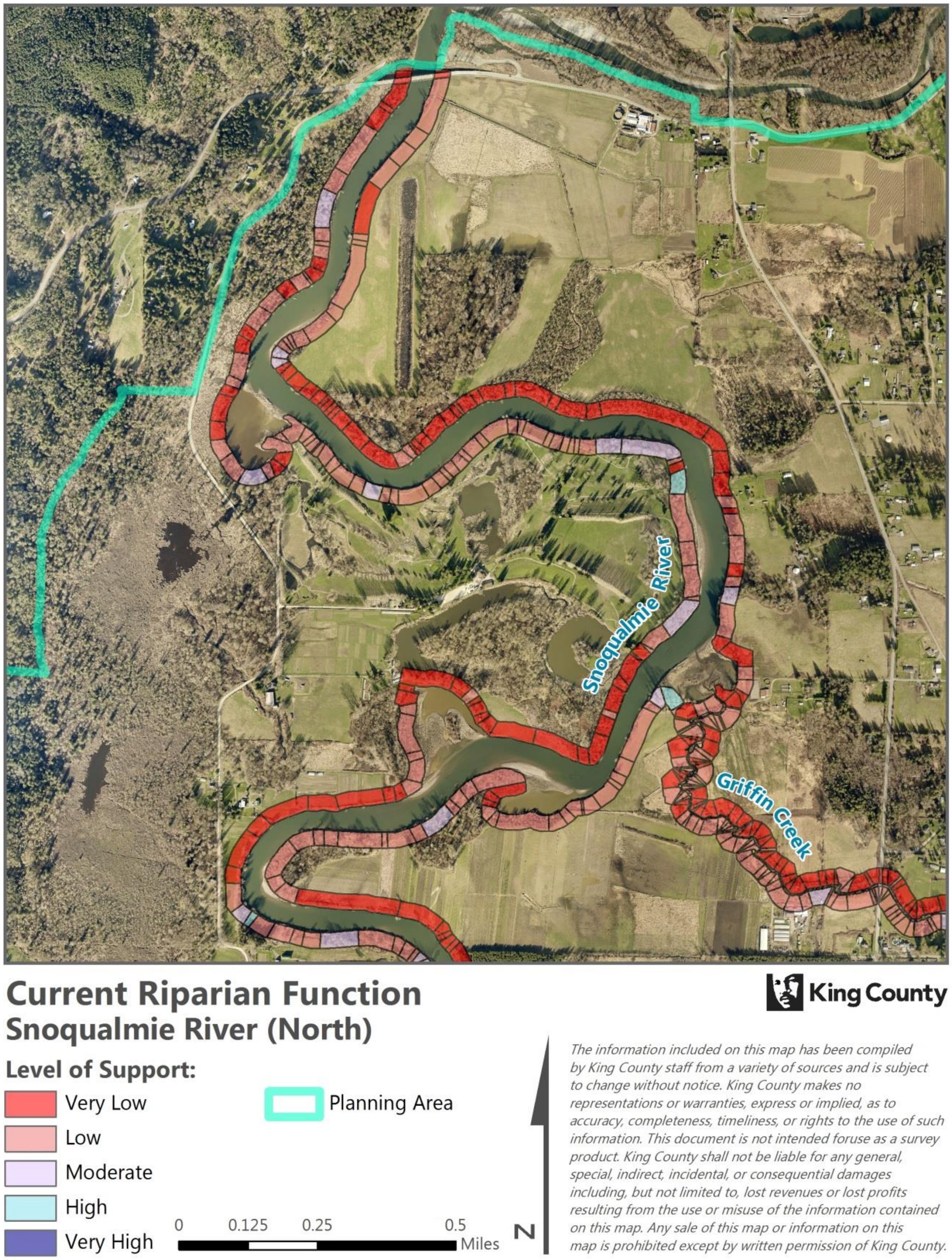

Figure 10. Current Riparian Function (North)

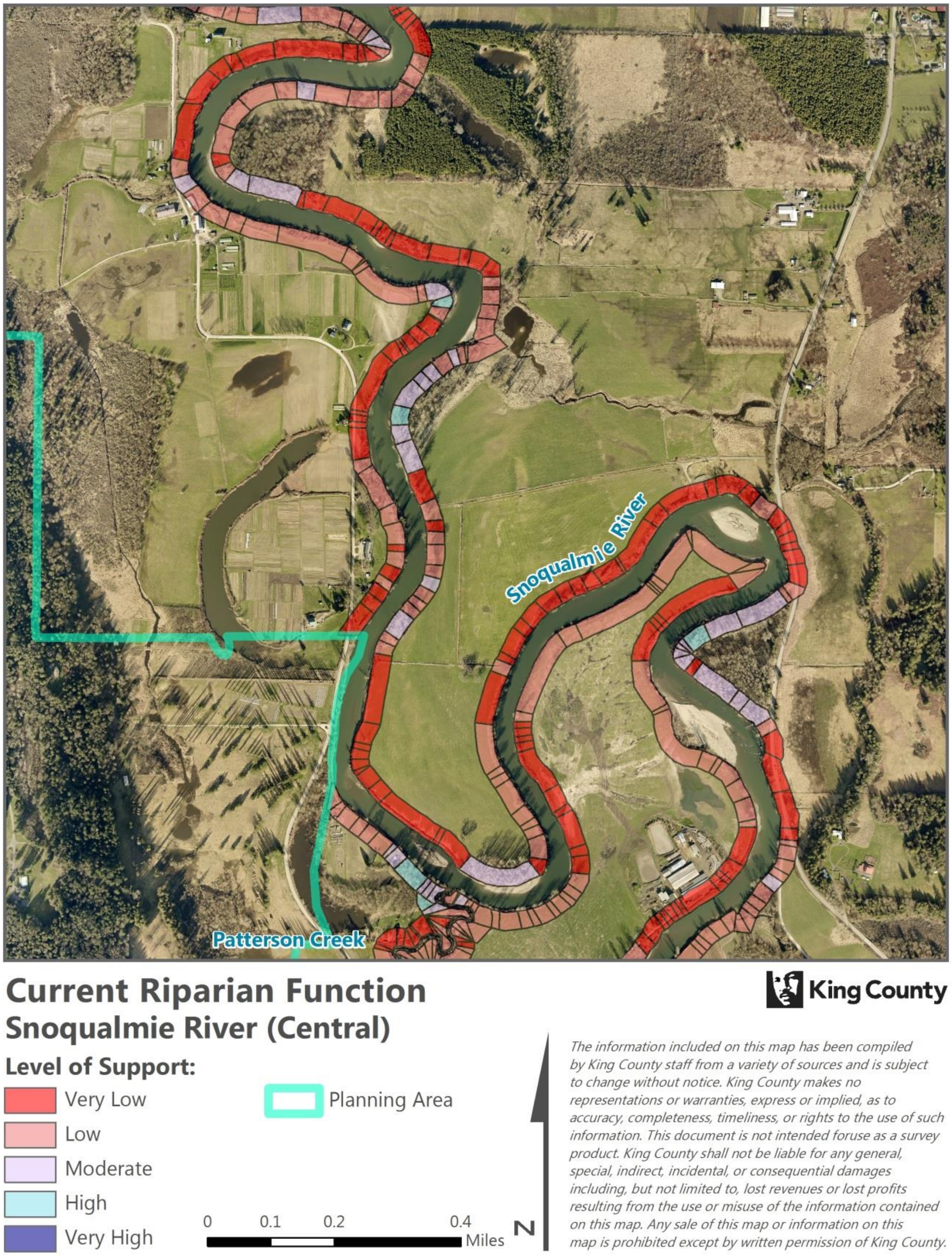

Figure 11. Current Riparian Function (Central)

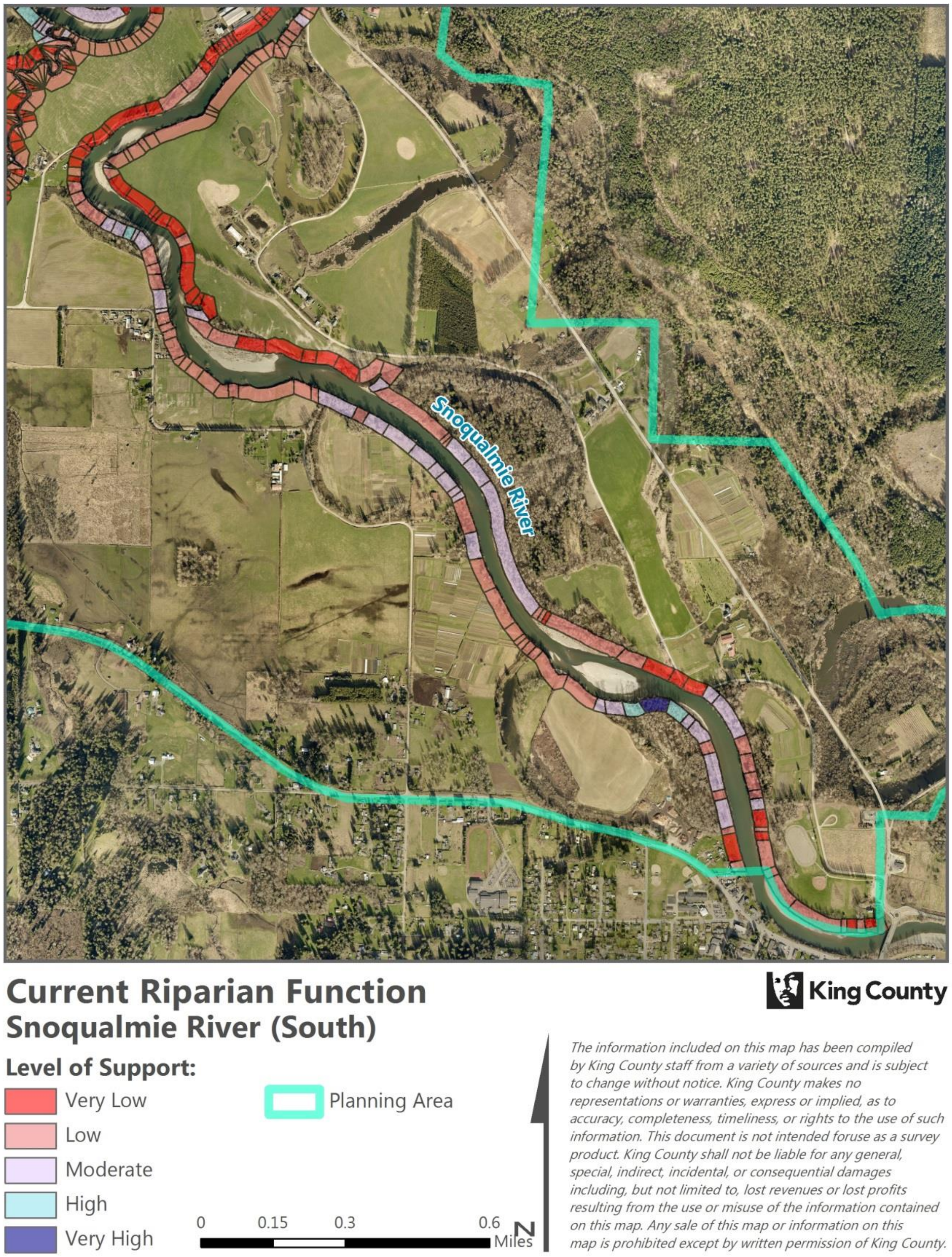

Figure 12. Current Riparian Function (South)

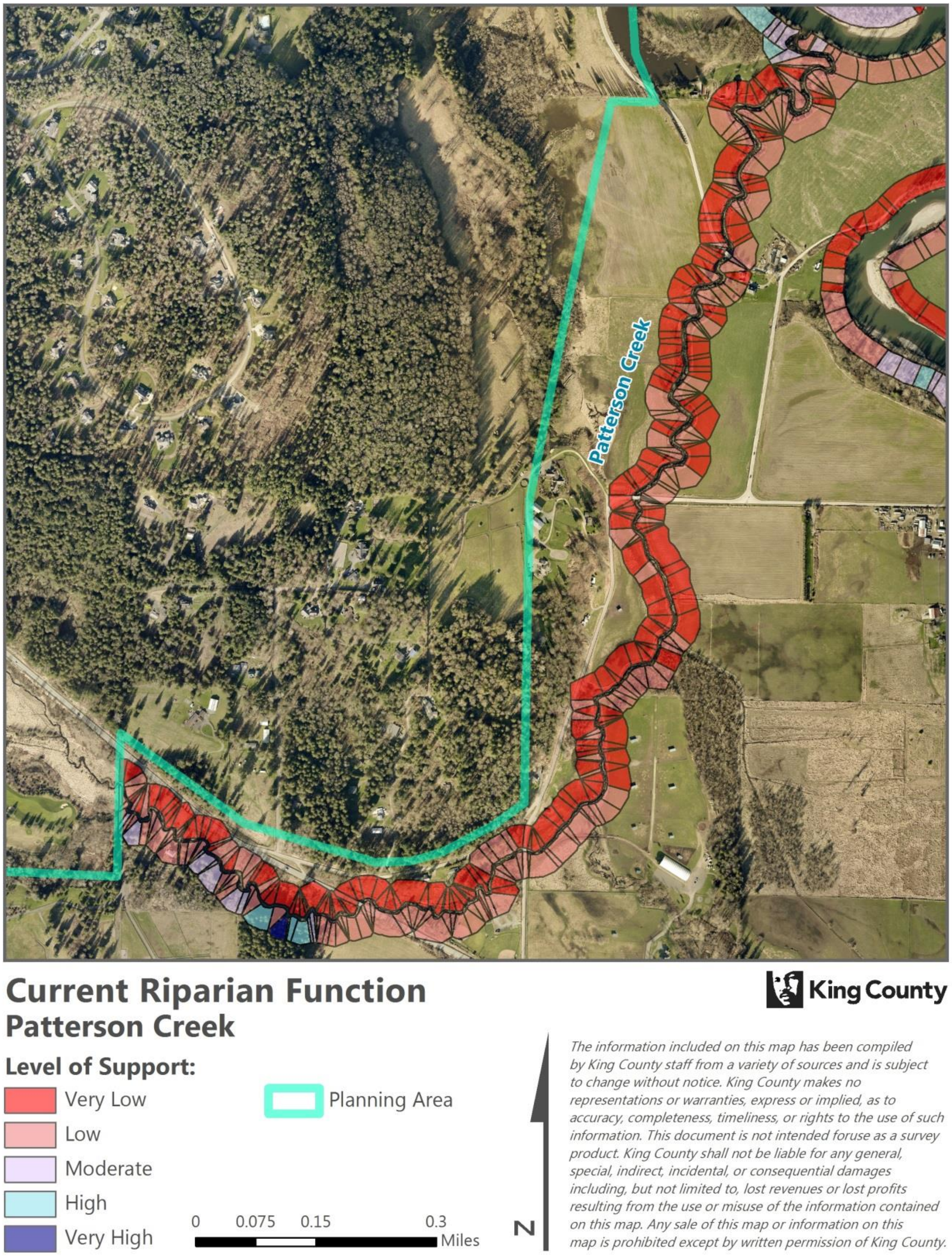

Figure 13. Current Riparian Function (Patterson Creek)

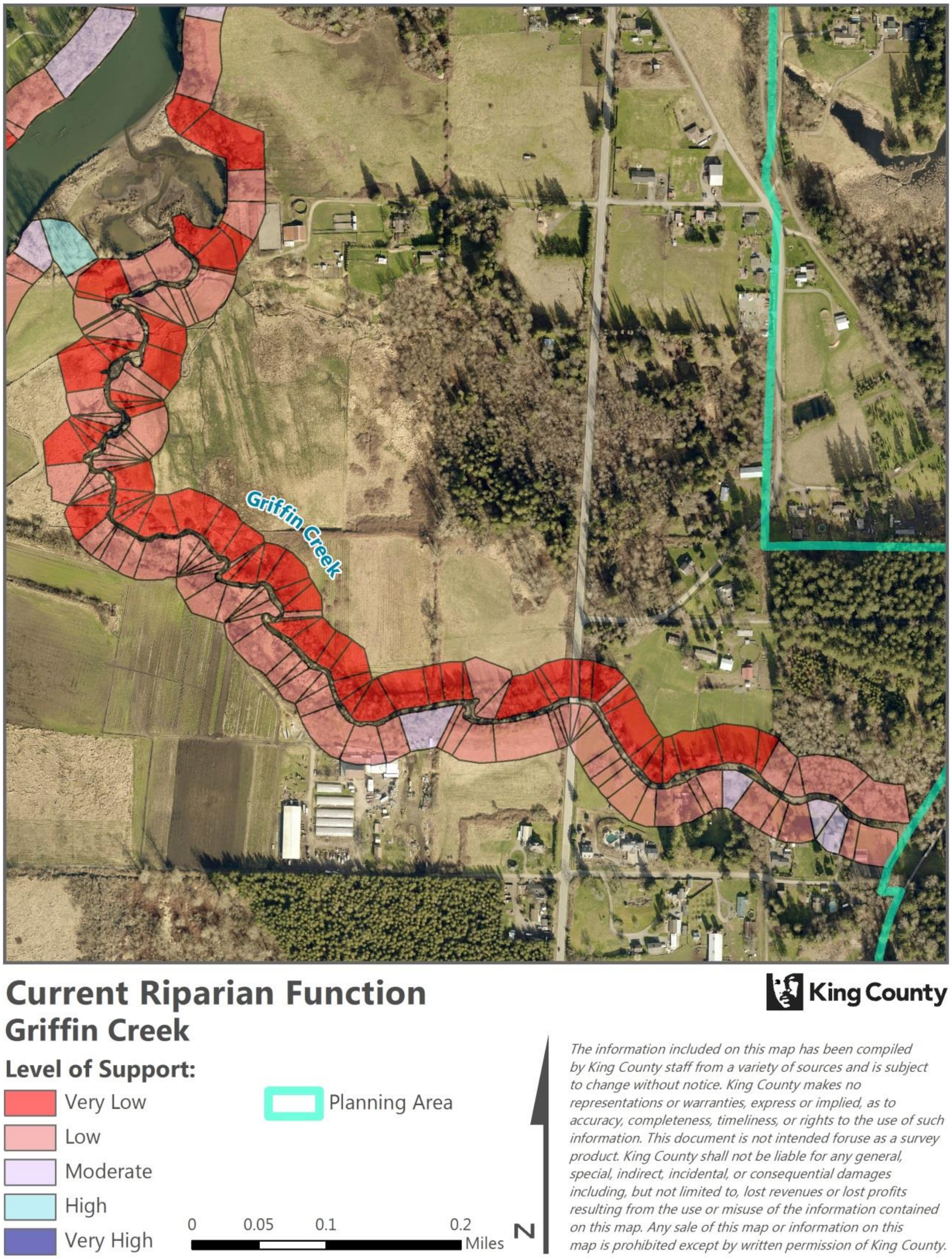

Figure 14. Current Riparian Function (Griffin Creek)

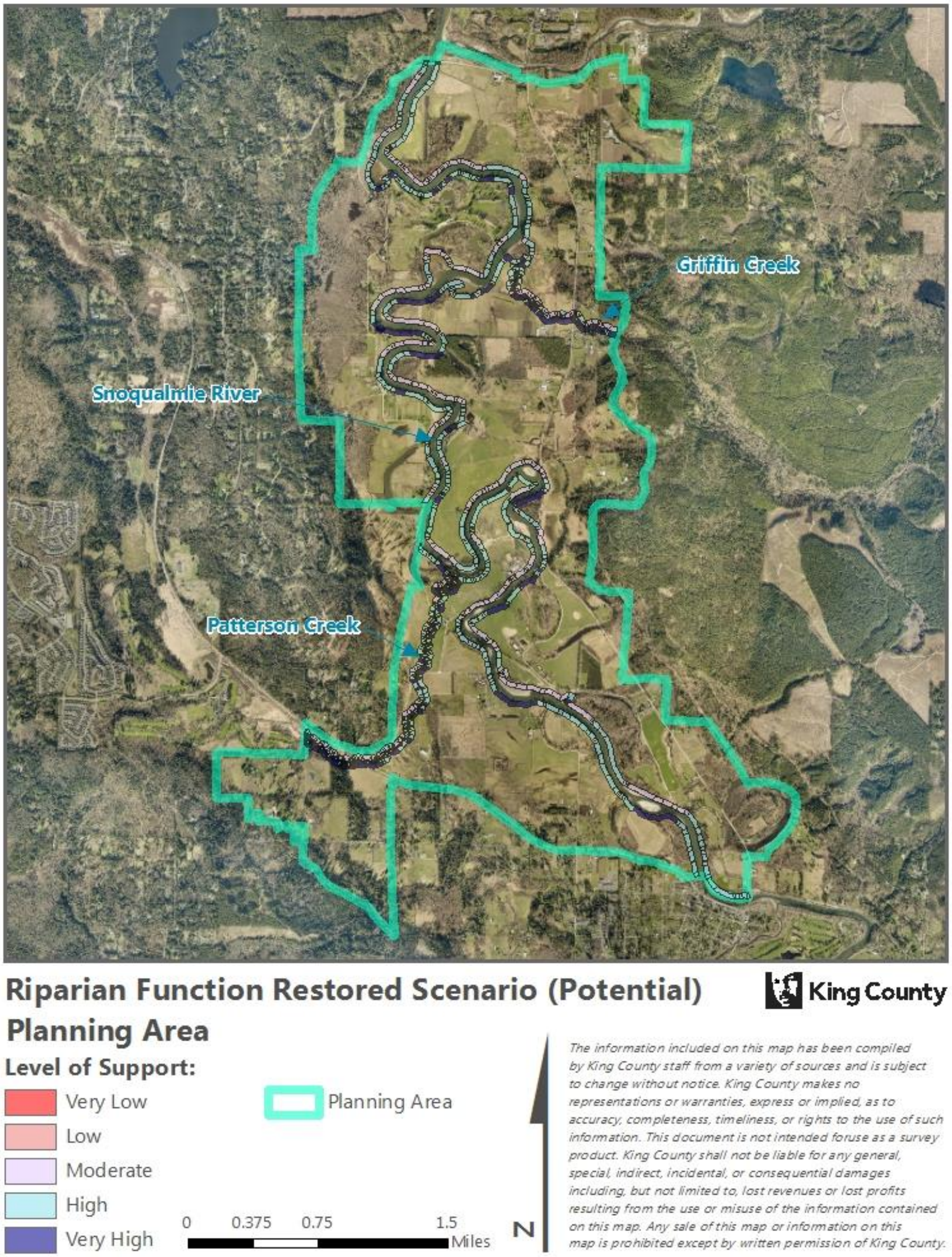

Figure 15. Riparian Function Restored Scenario (Planning Area)

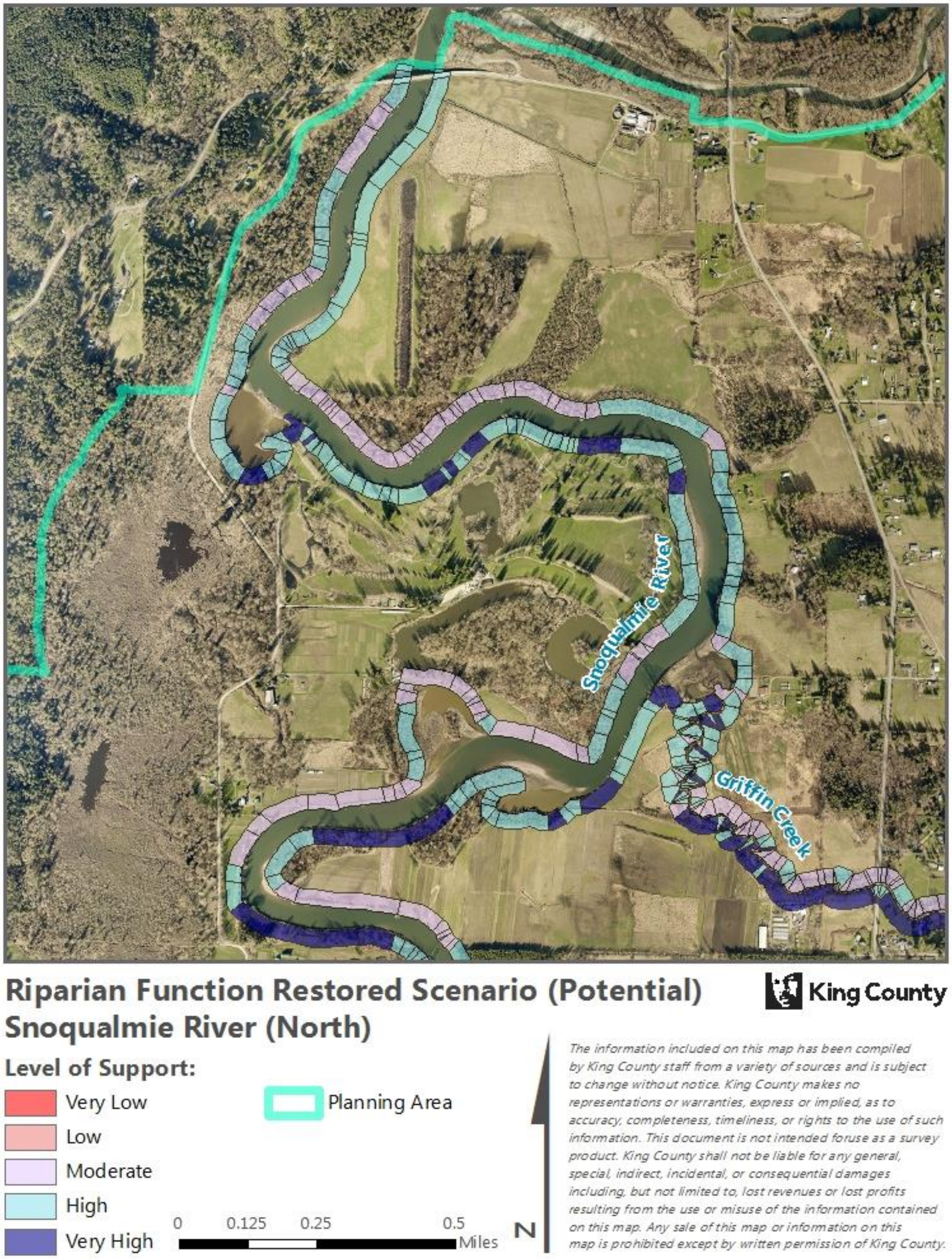

Figure 16. Riparian Function Restored Scenario (North)

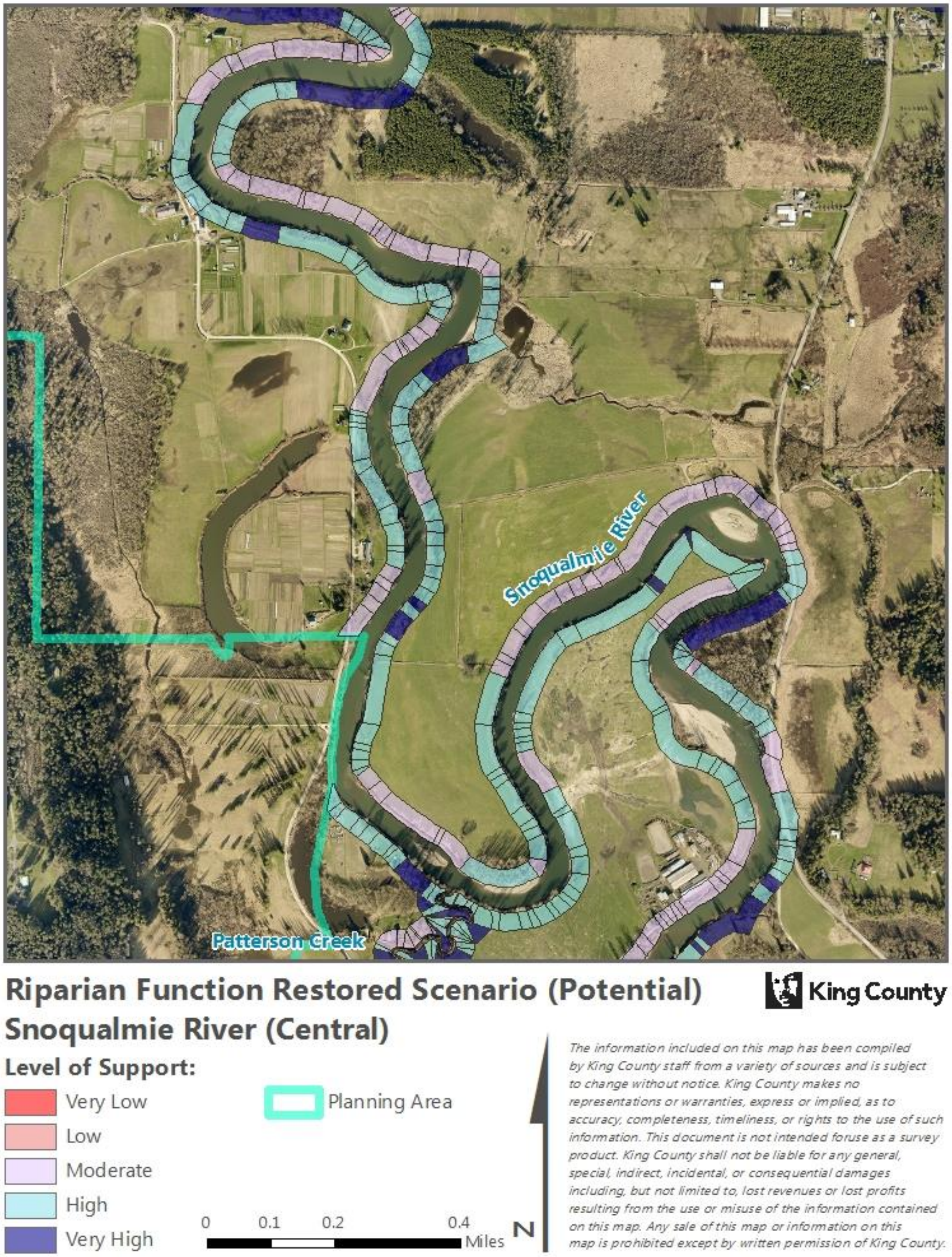

Figure 17. Riparian Function Restored Scenario (Central)

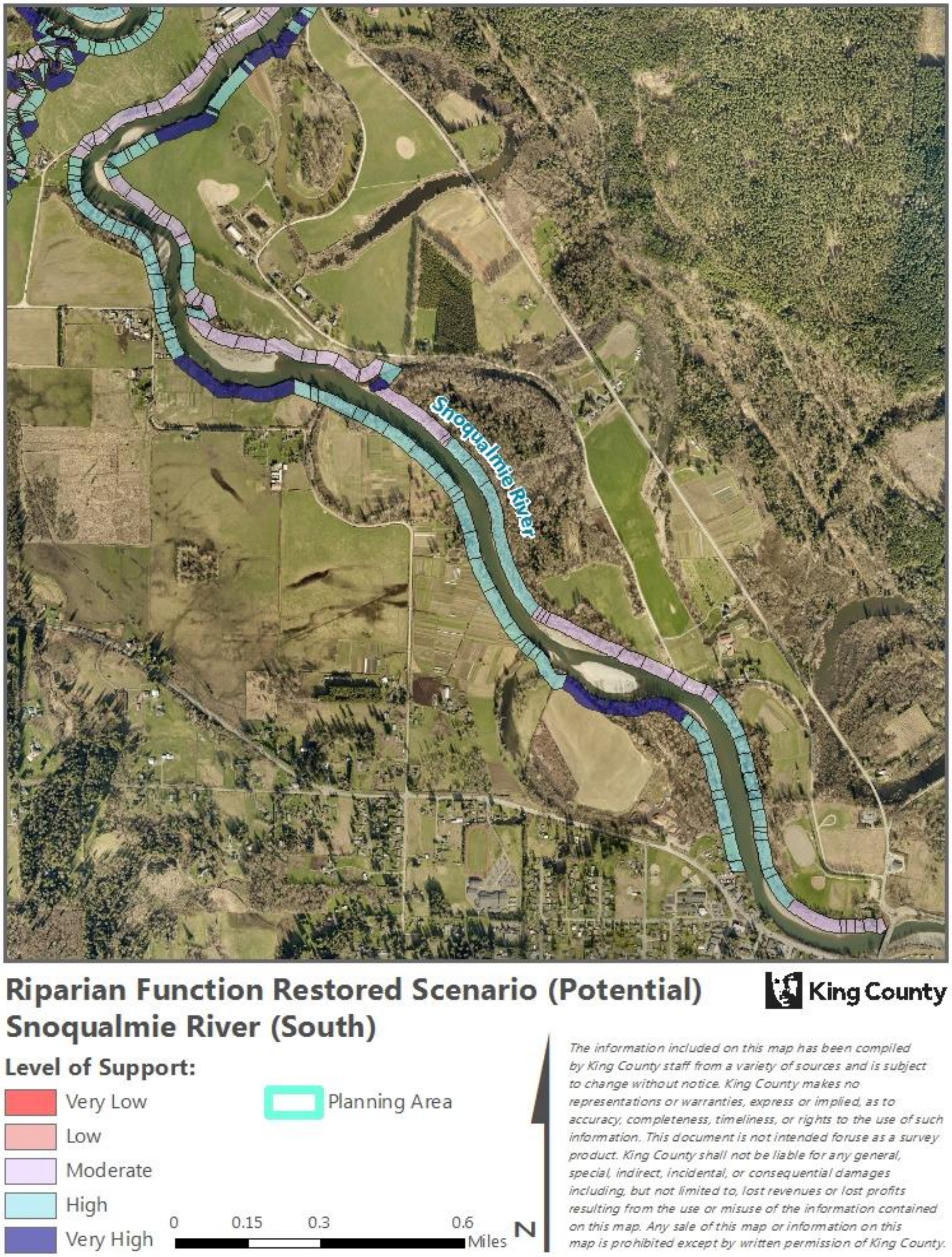

Figure 18. Riparian Function Restored Scenario (South)

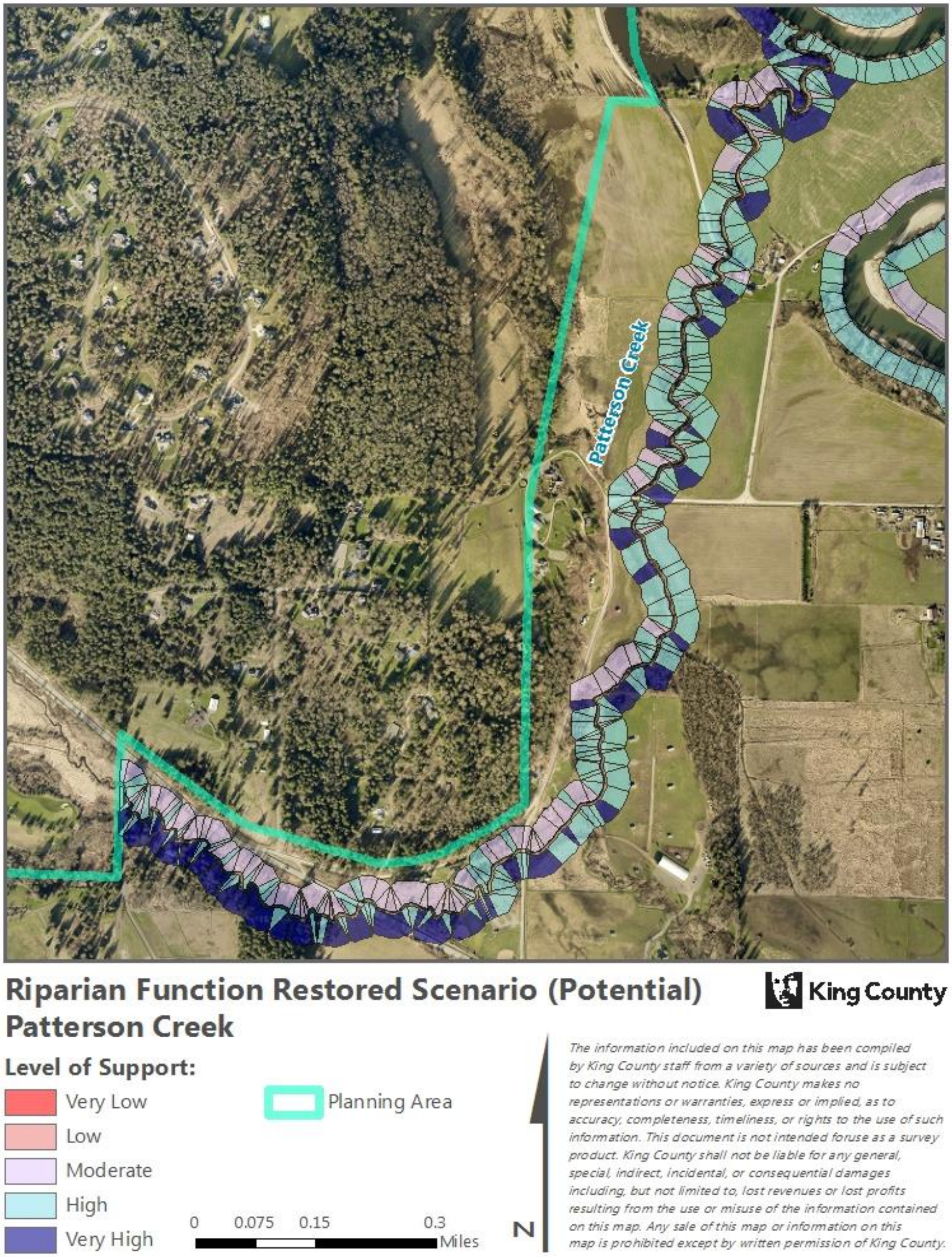

Figure 19. Riparian Function Restored (Patterson Creek)

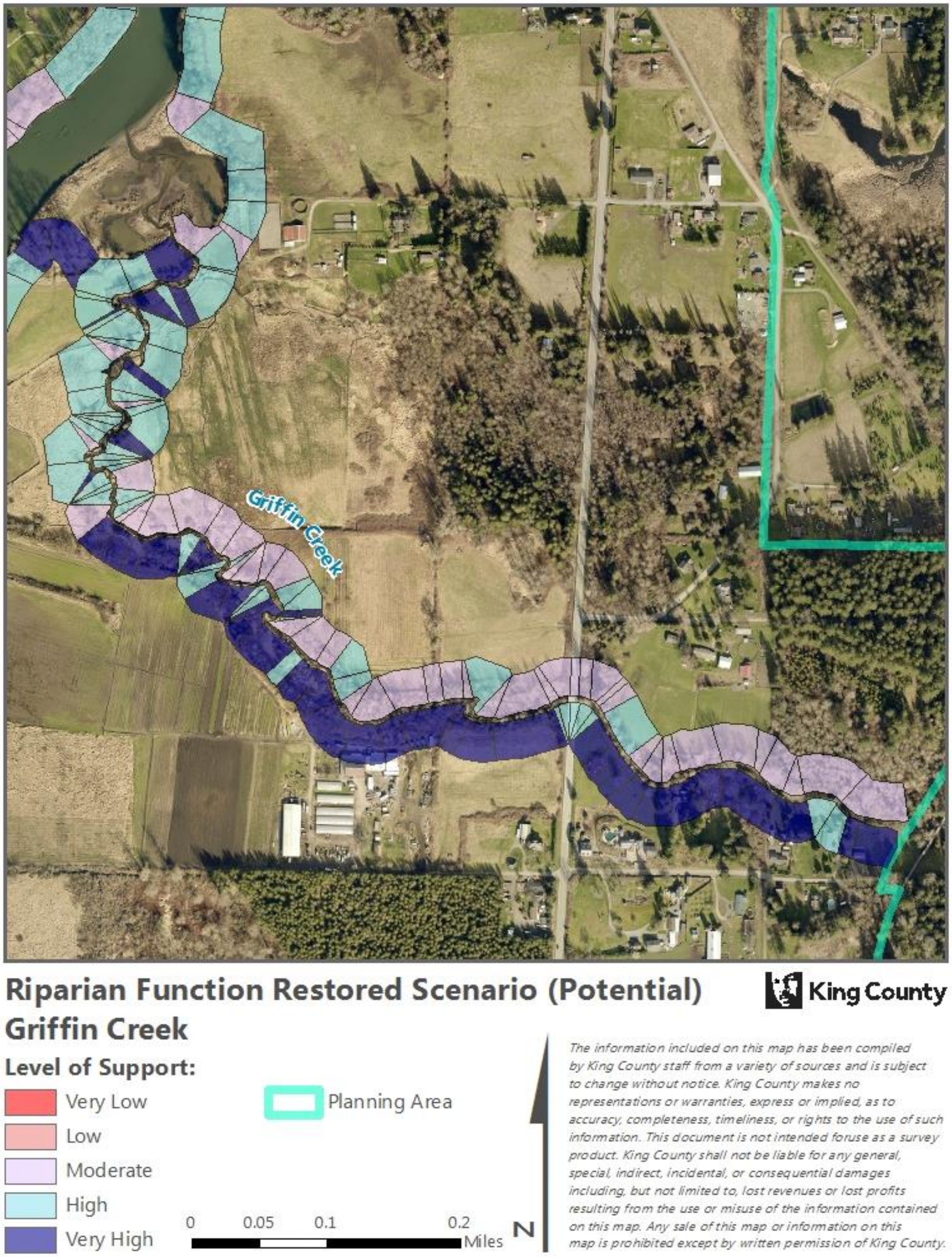

Figure 20. Riparian Function Restored (Griffin Creek)

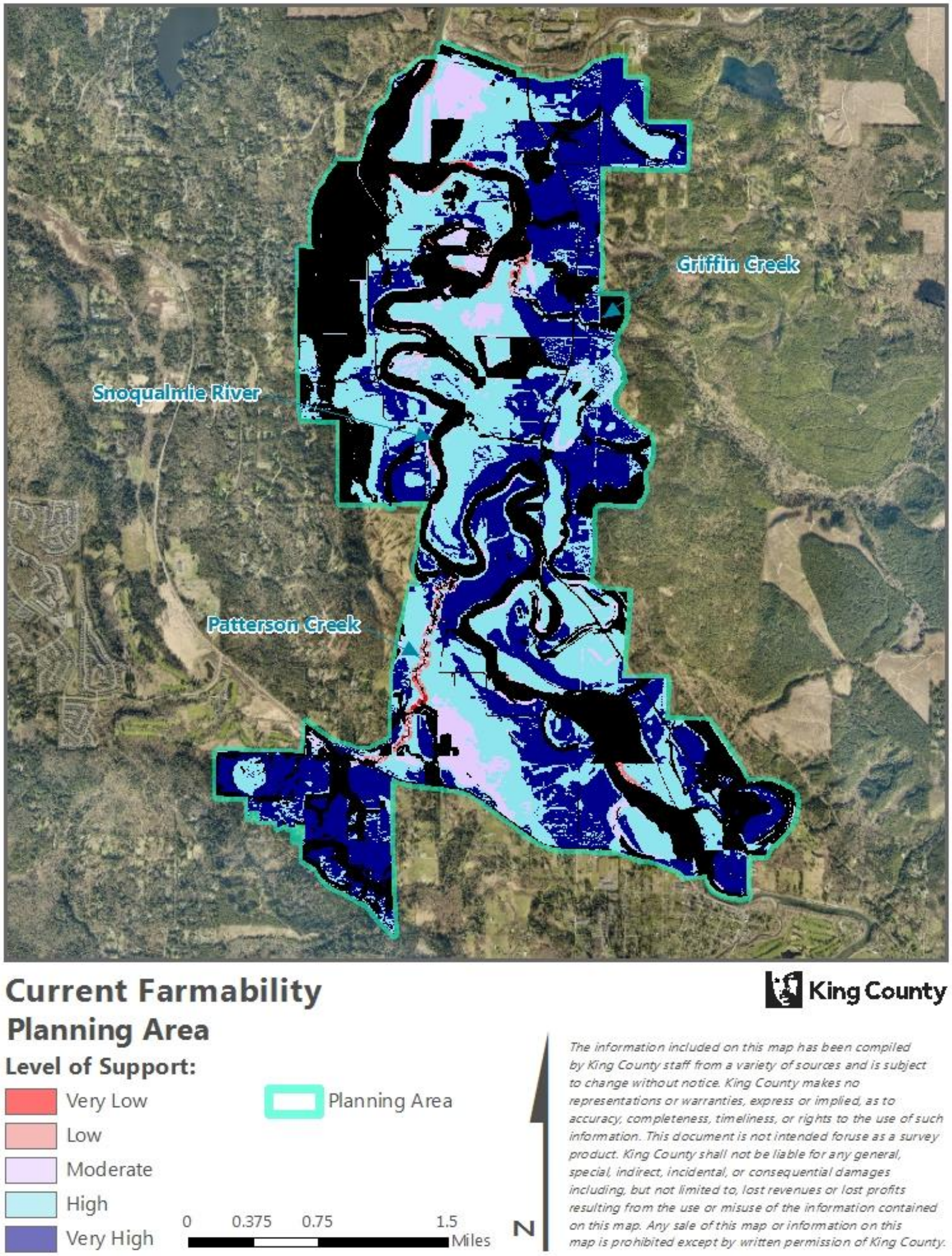

Figure 21. Current Farmability (Planning Area)

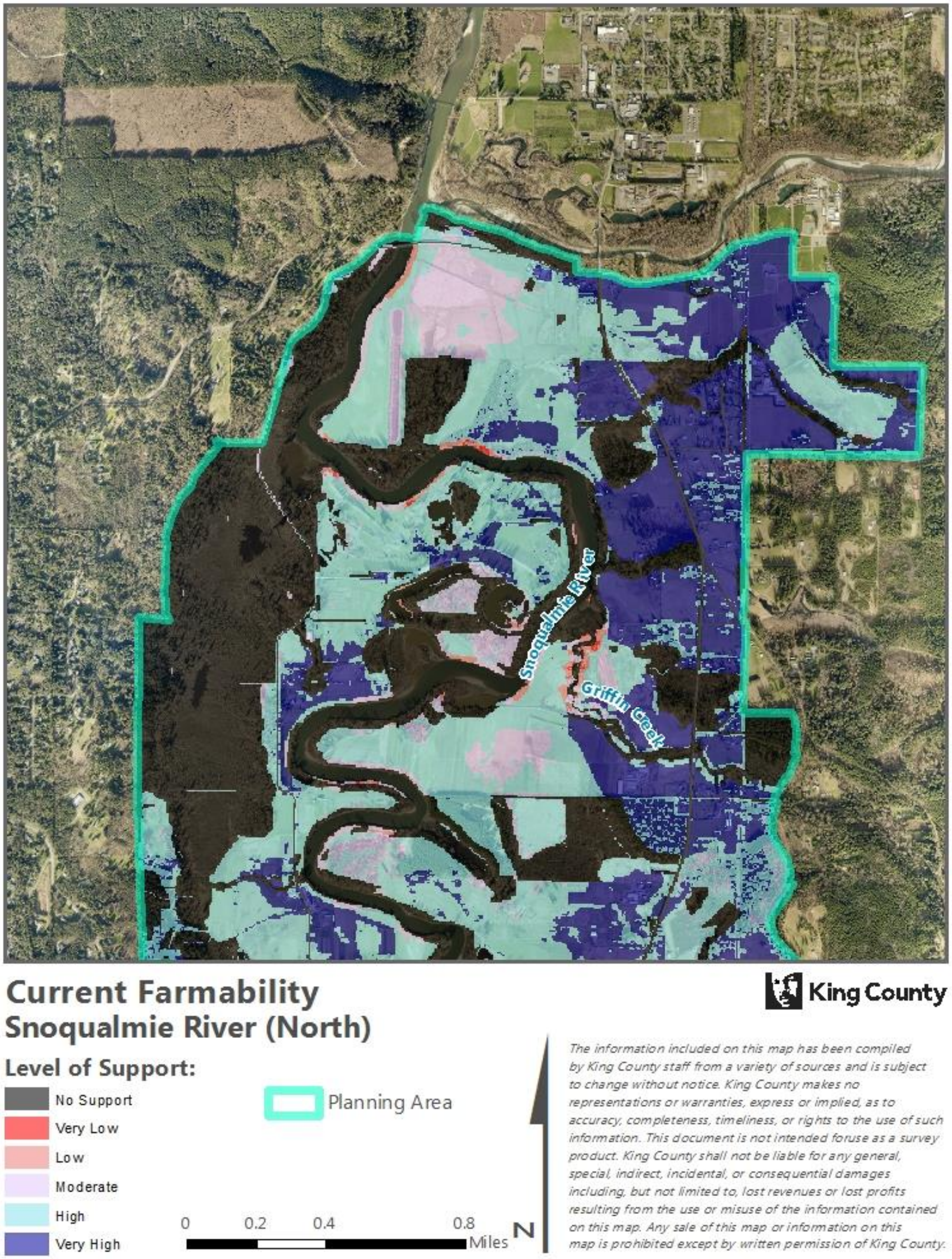

Figure 22. Current Farmability (North)

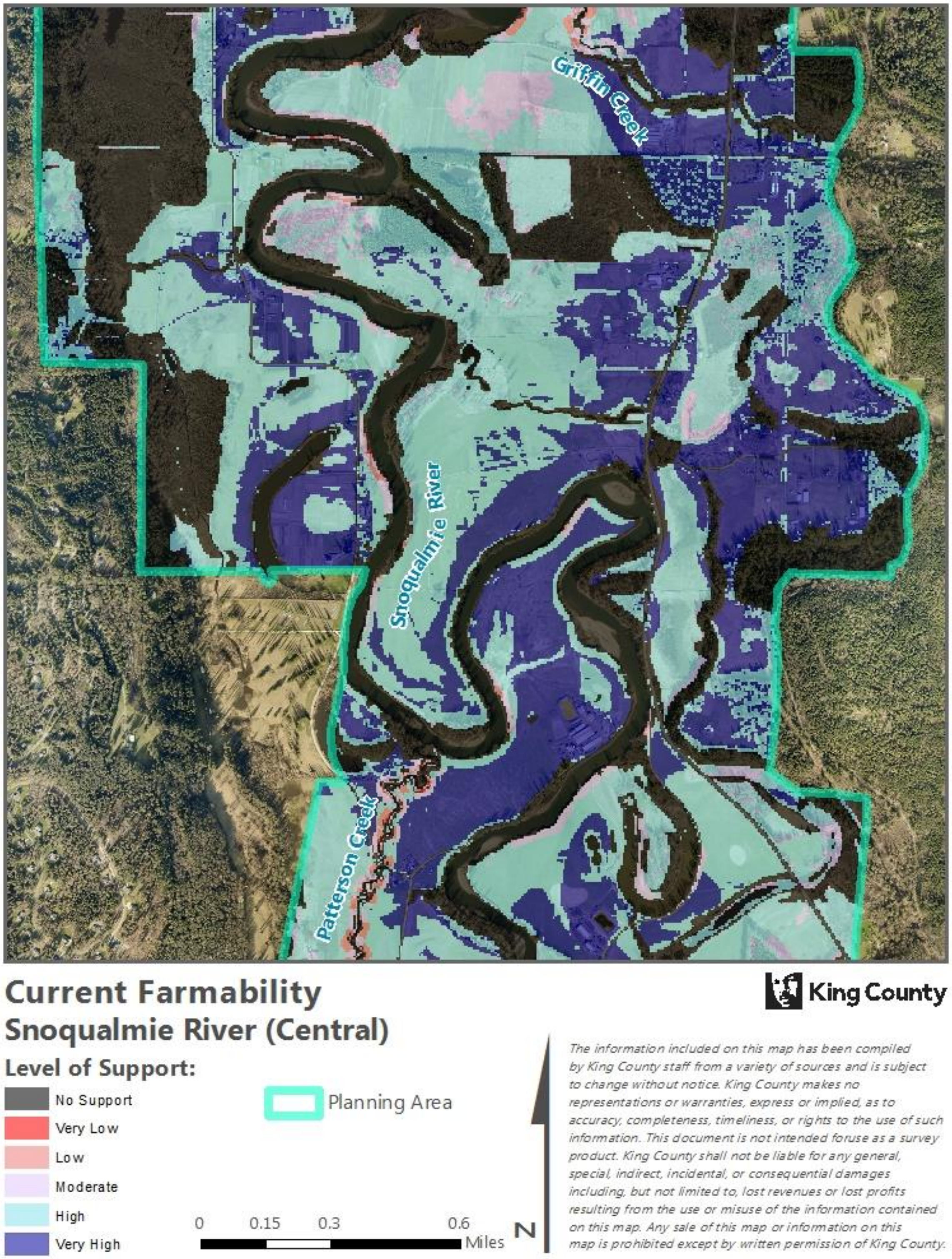

Figure 23. Current Farmability (Central)

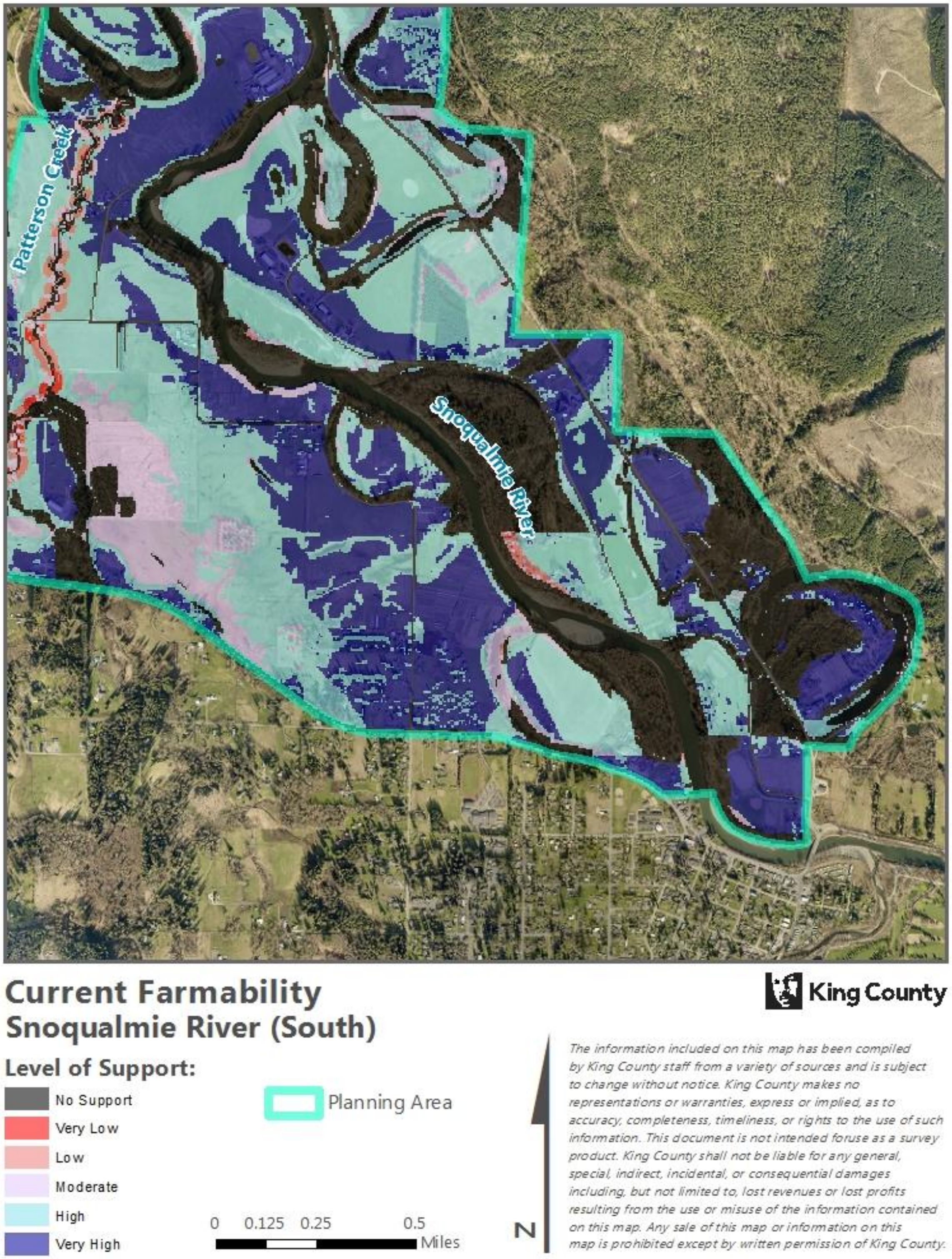

Figure 24. Current Farmability (South)

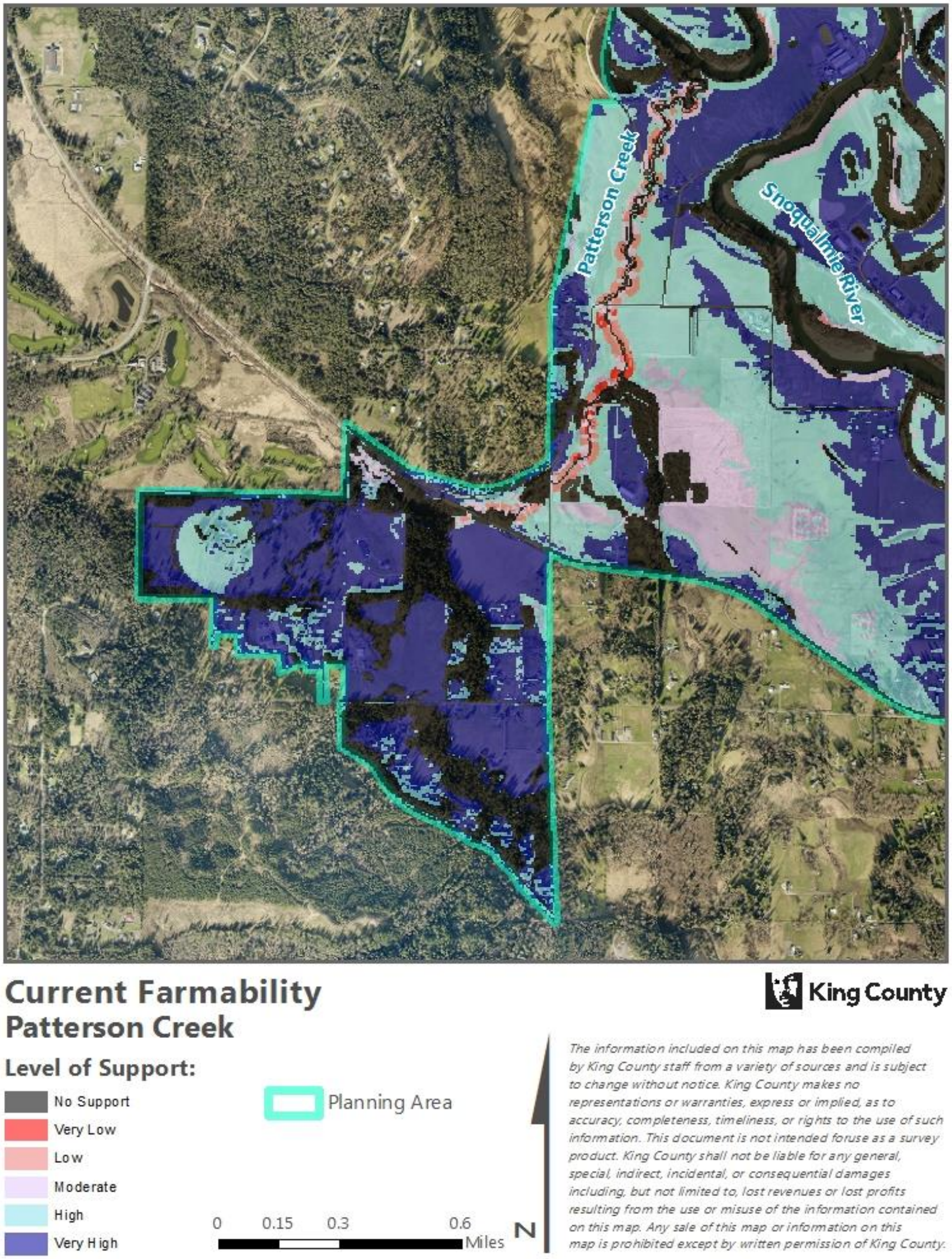

Figure 25. Current Farmability (Patterson Creek)

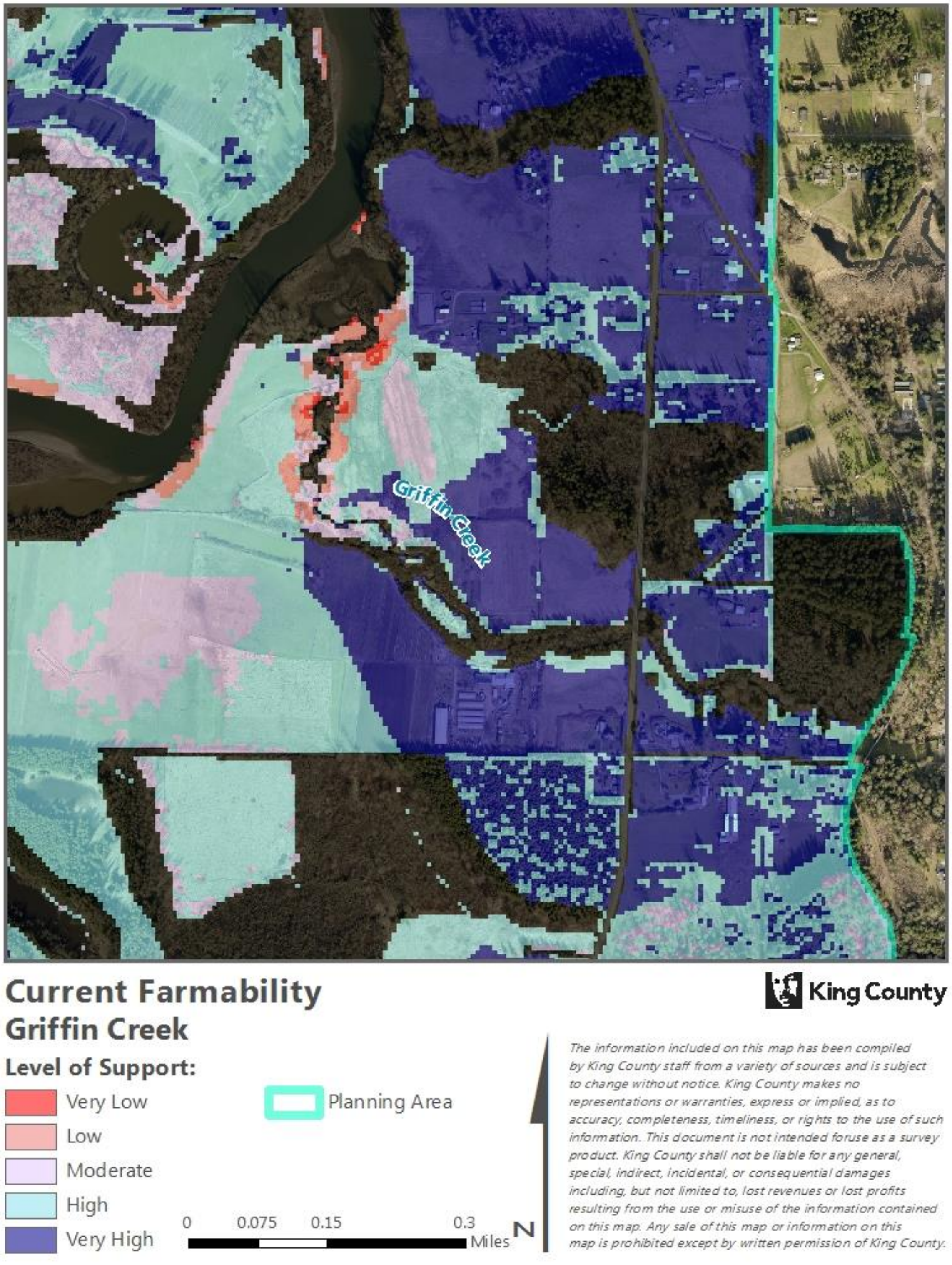

Figure 26. Current Farmability (Griffin Creek)

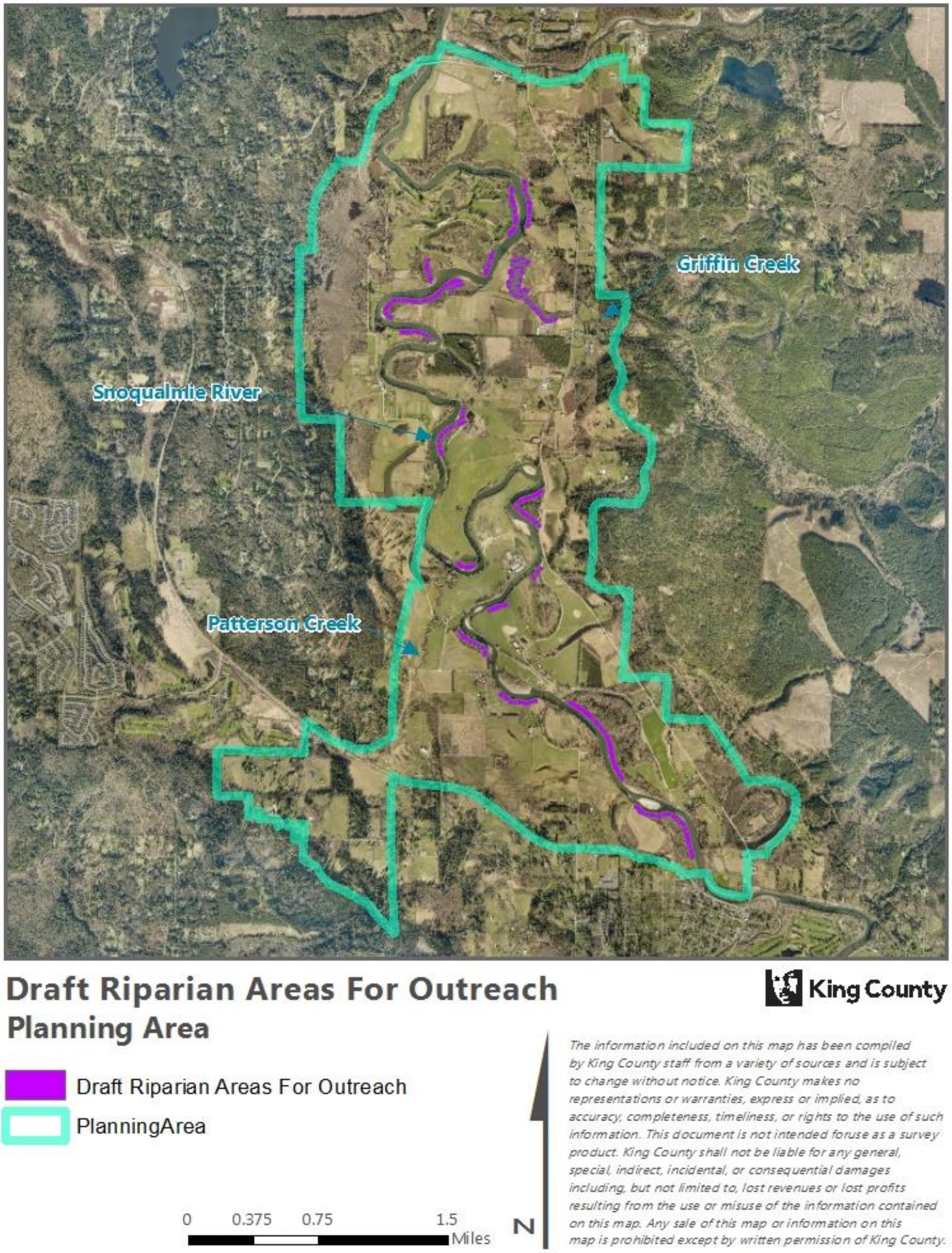

Figure 27. Riparian Easement Priorities EMDS (Planning Area)

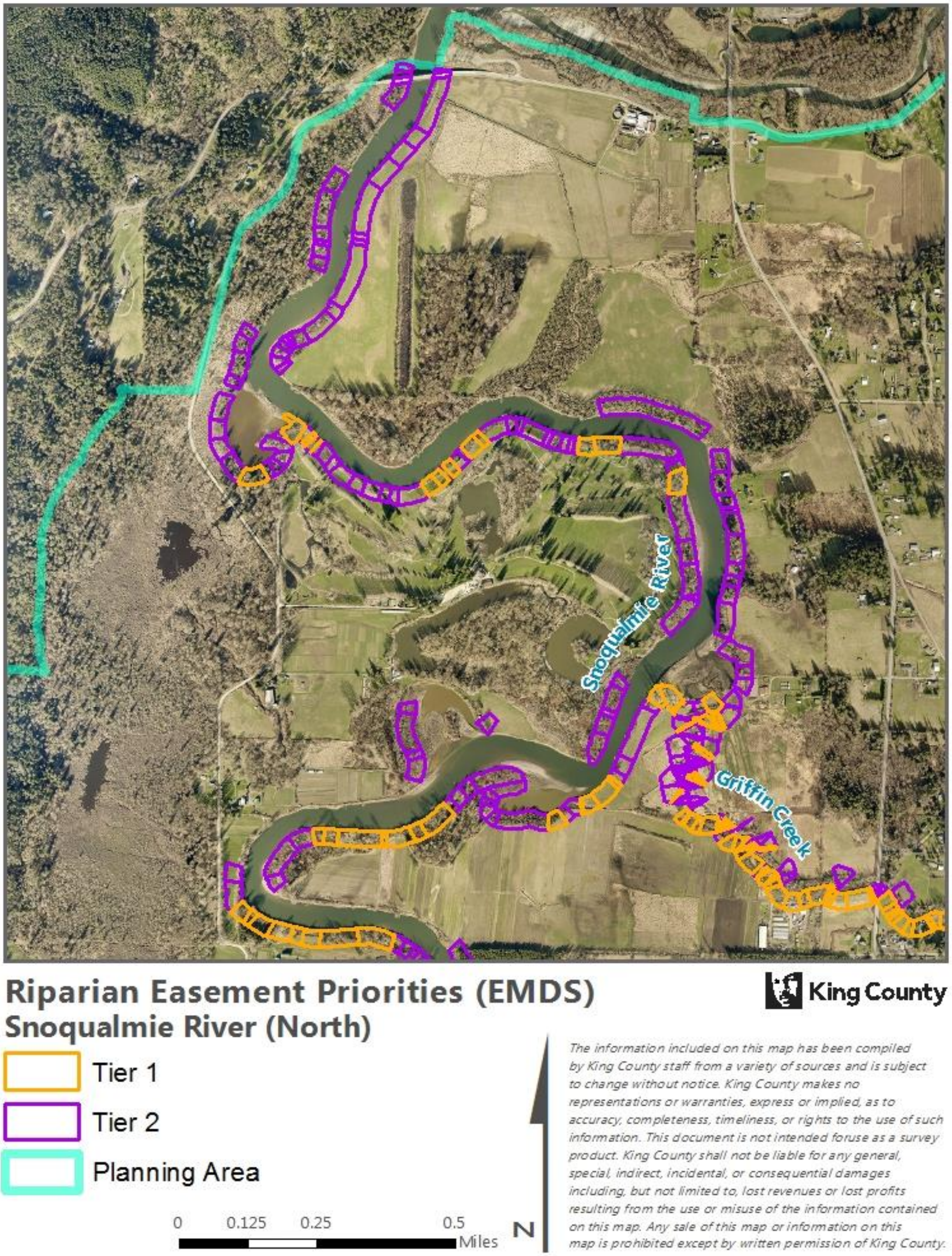

Figure 28. Riparian Easement Priorities EMDS (North)

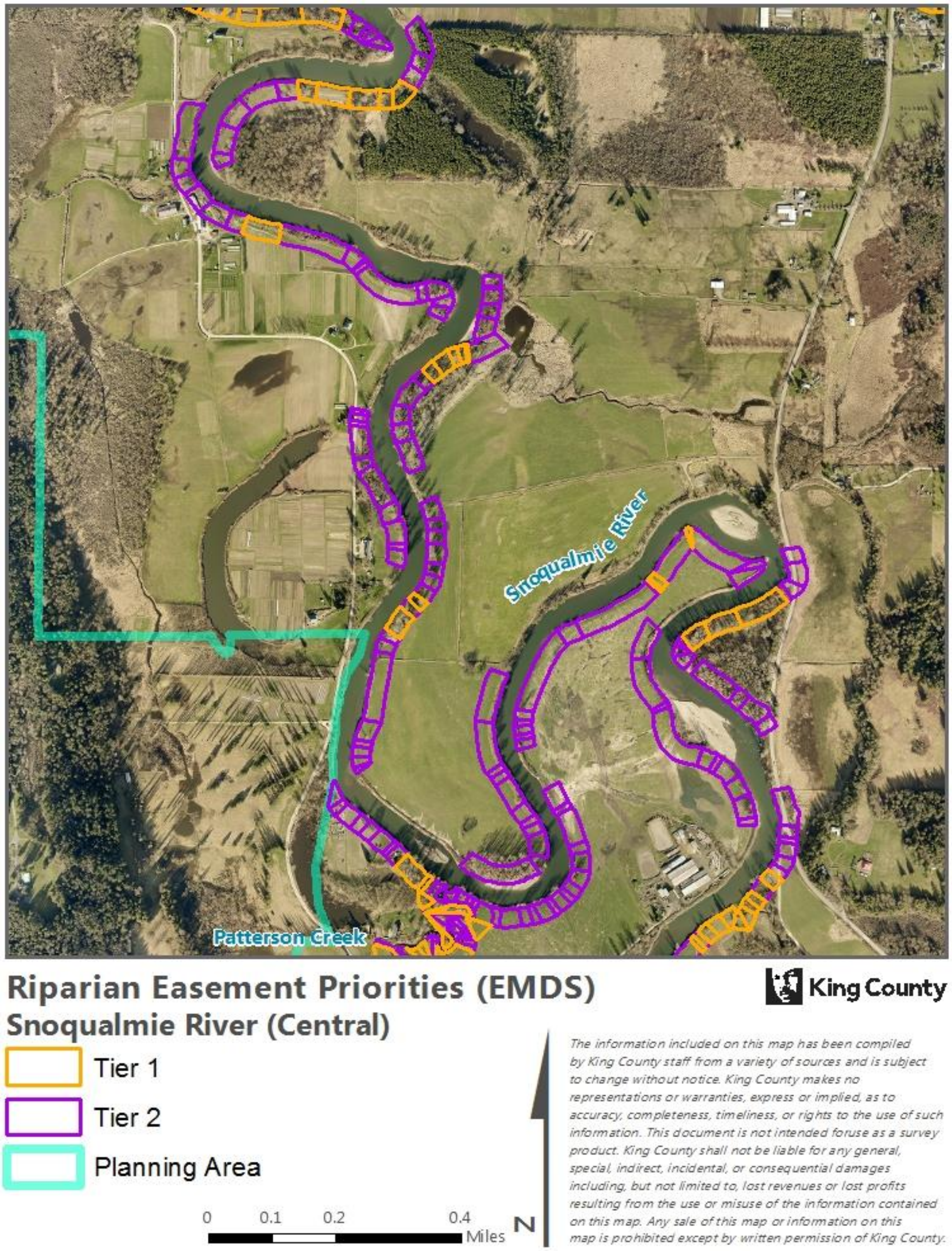

Figure 29. Riparian Easement Priorities EMDS (Central)

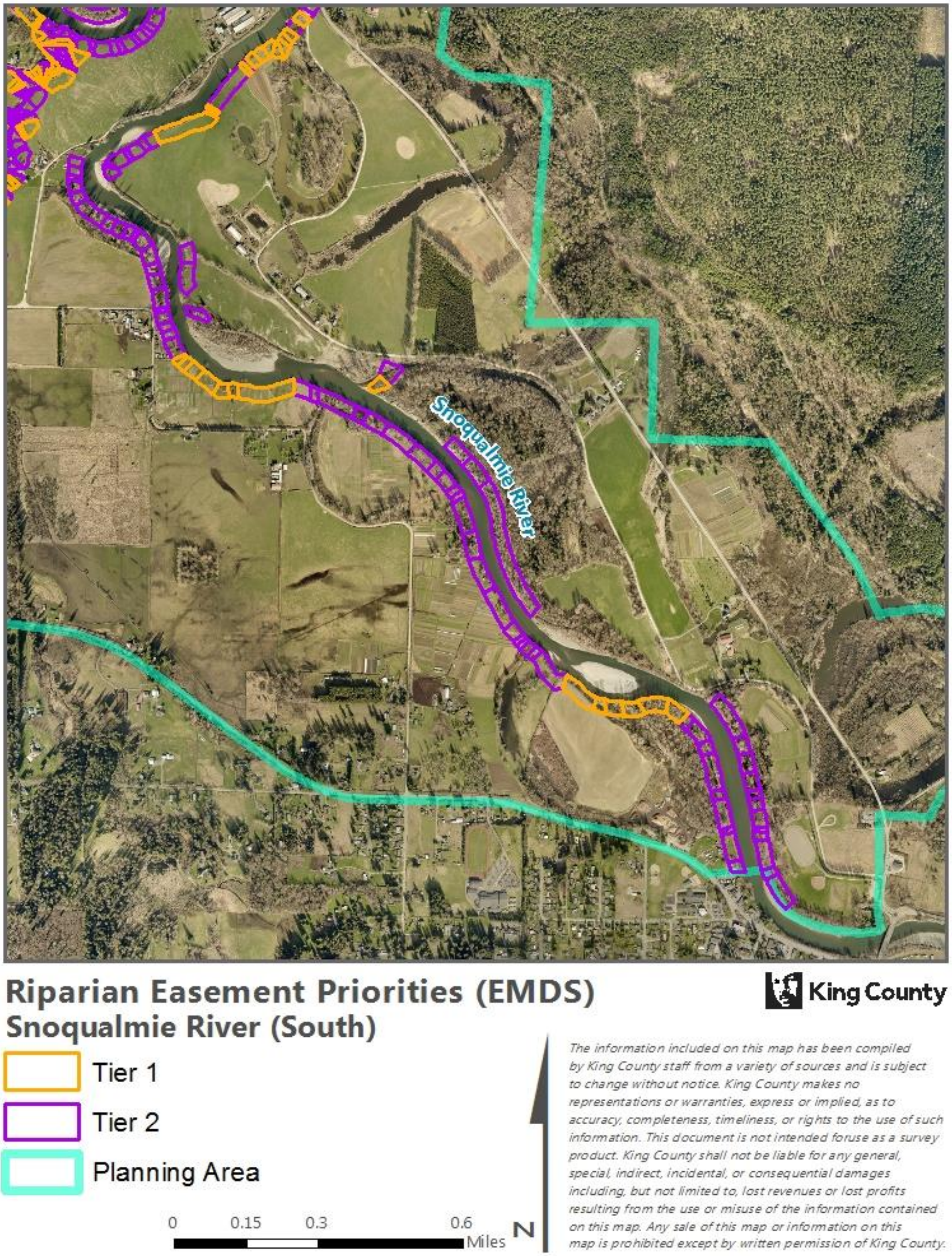

Figure 30. Riparian Easement Priorities EMDS (South)

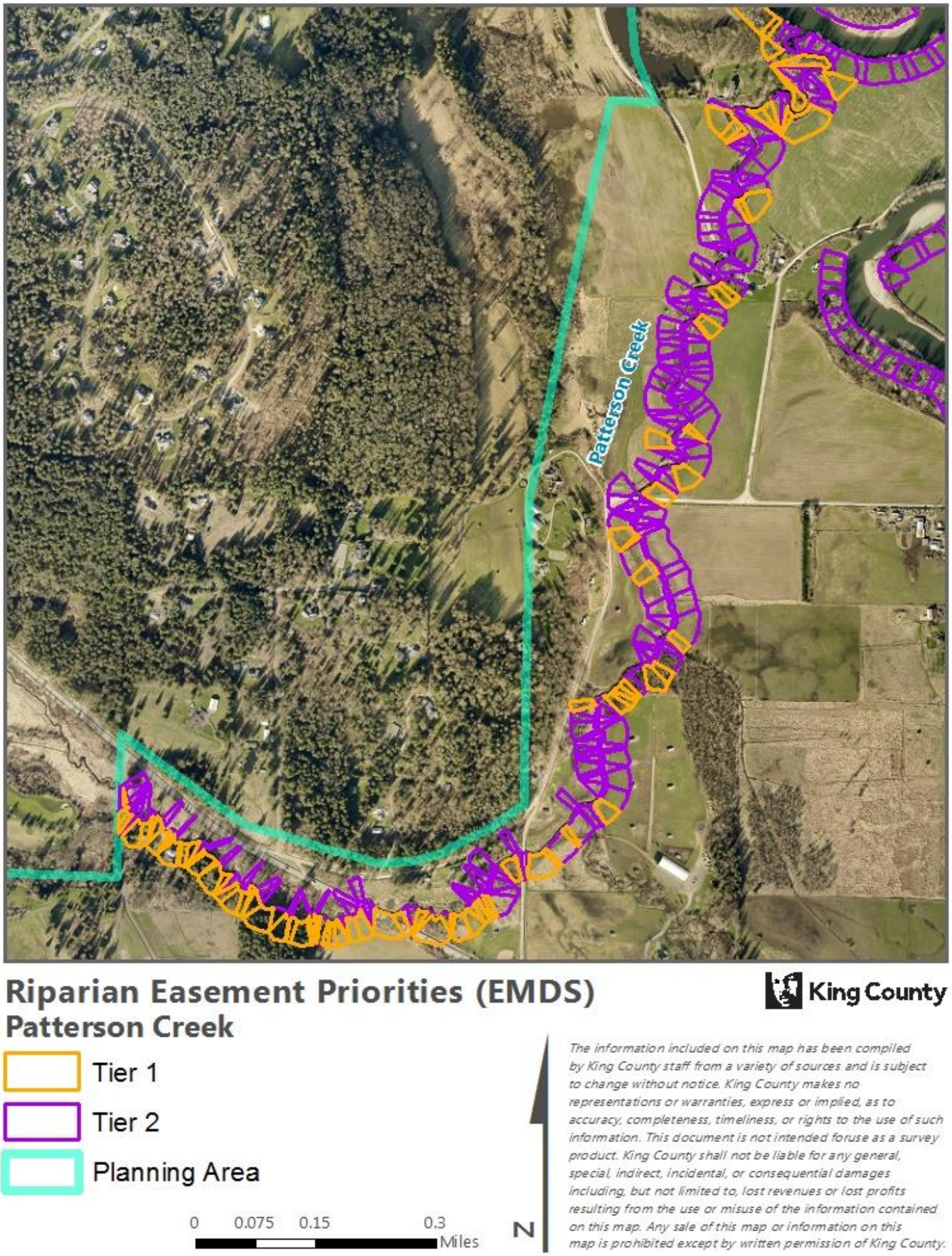

Figure 31. Riparian Easement Priorities EMDS (Patterson Creek)

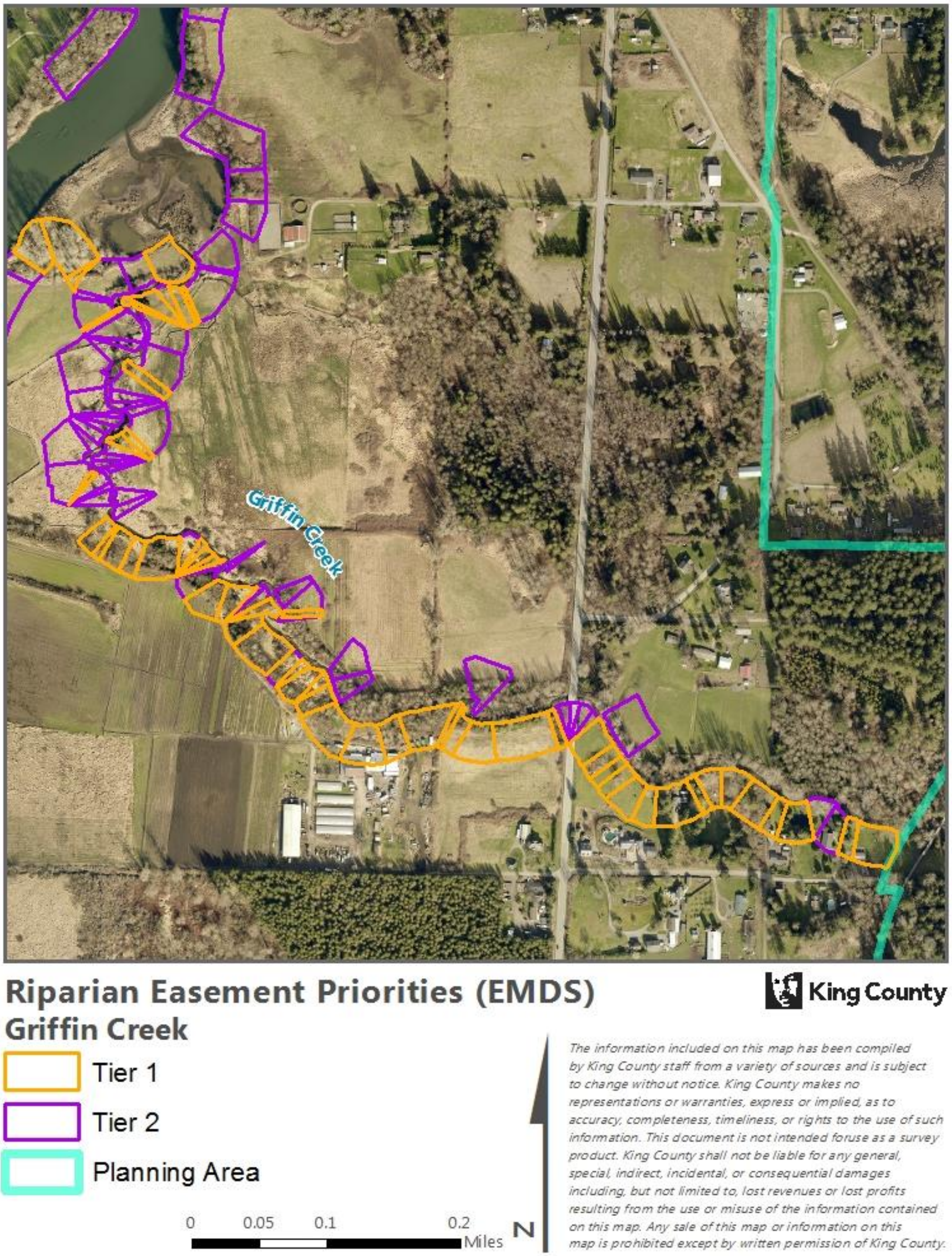

Figure 32. Riparian Easement Priorities EMDS (Griffin Creek)

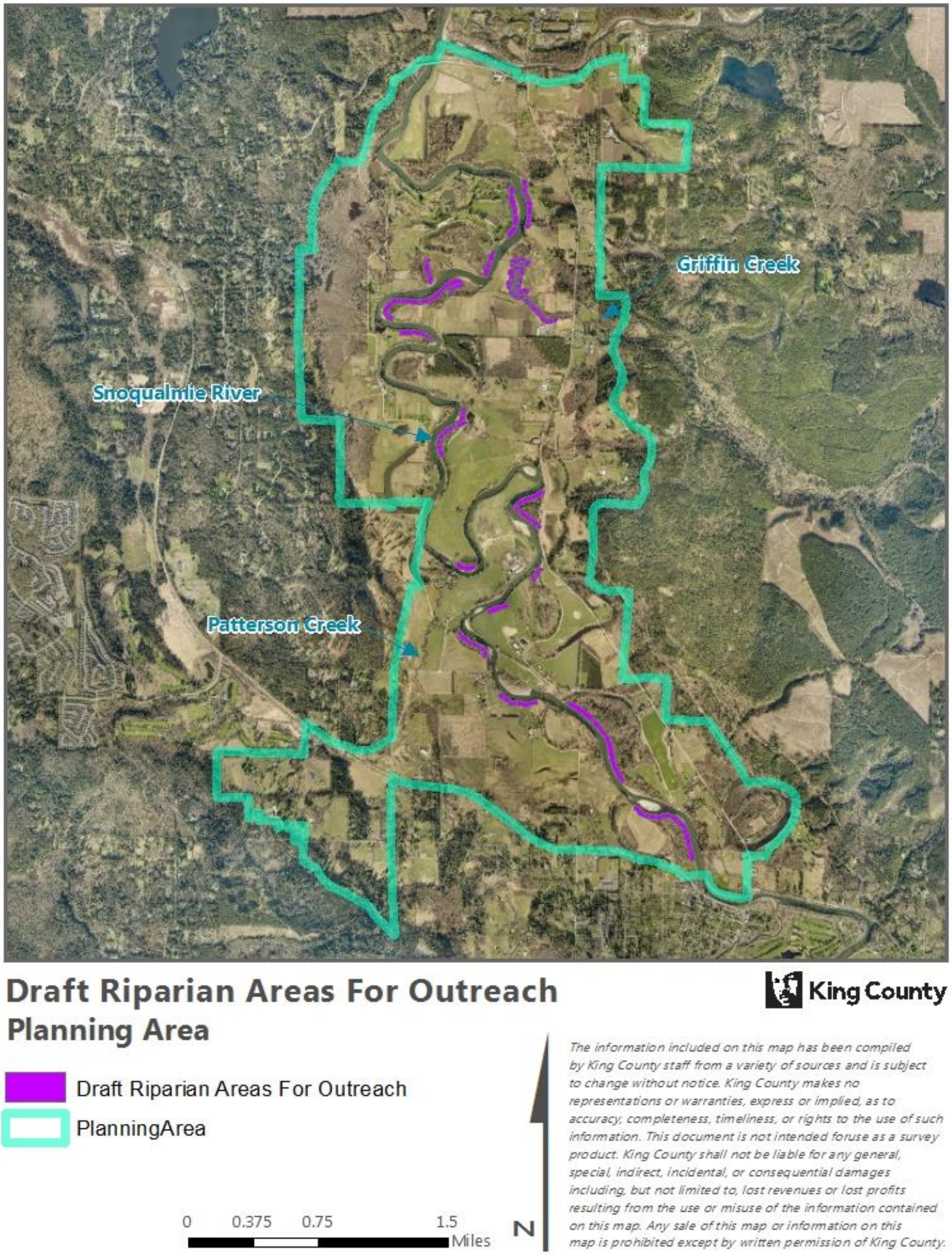

Figure 33. Riparian Areas For Outreach (Planning Area)

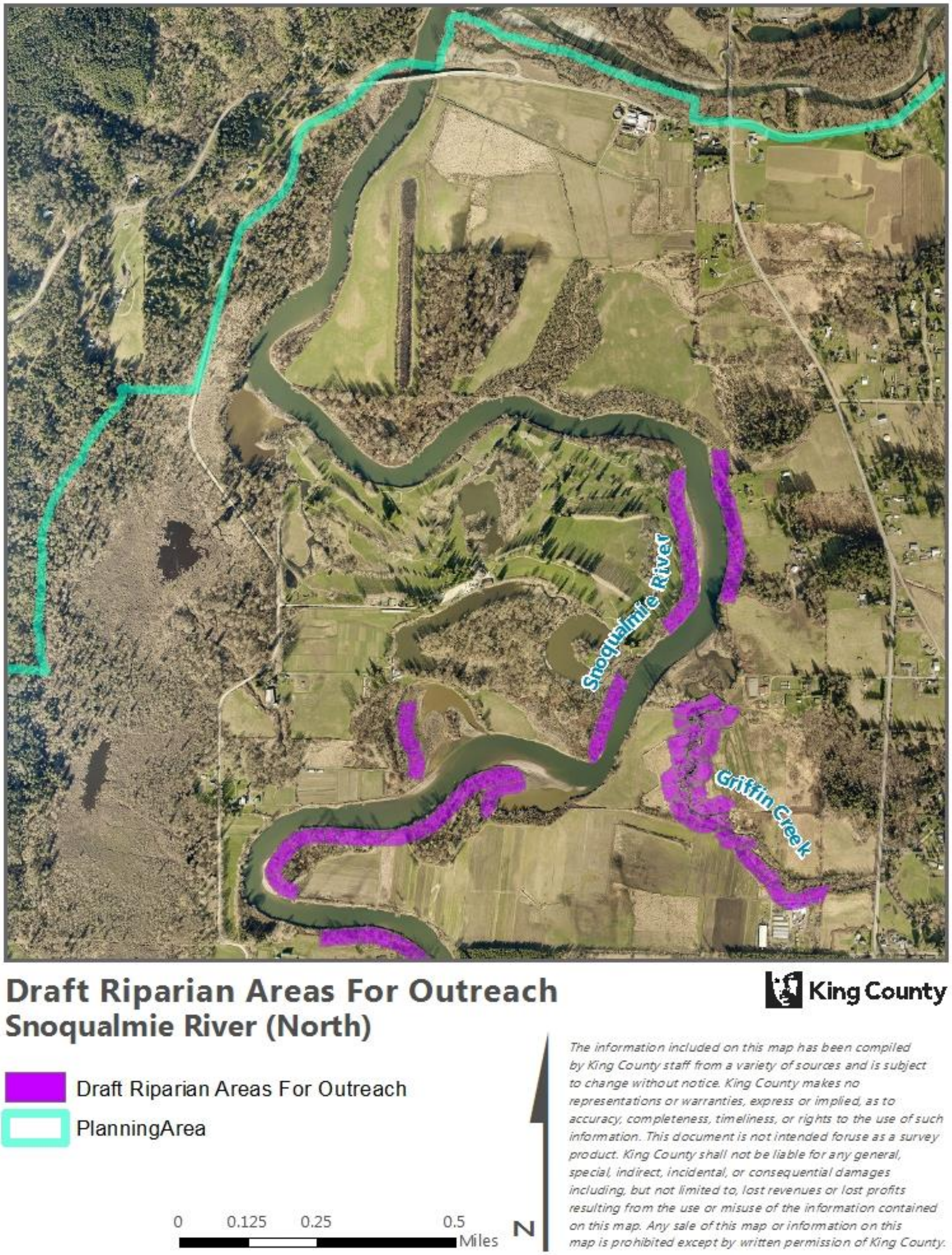

Figure 34. Riparian Areas For Outreach (North)

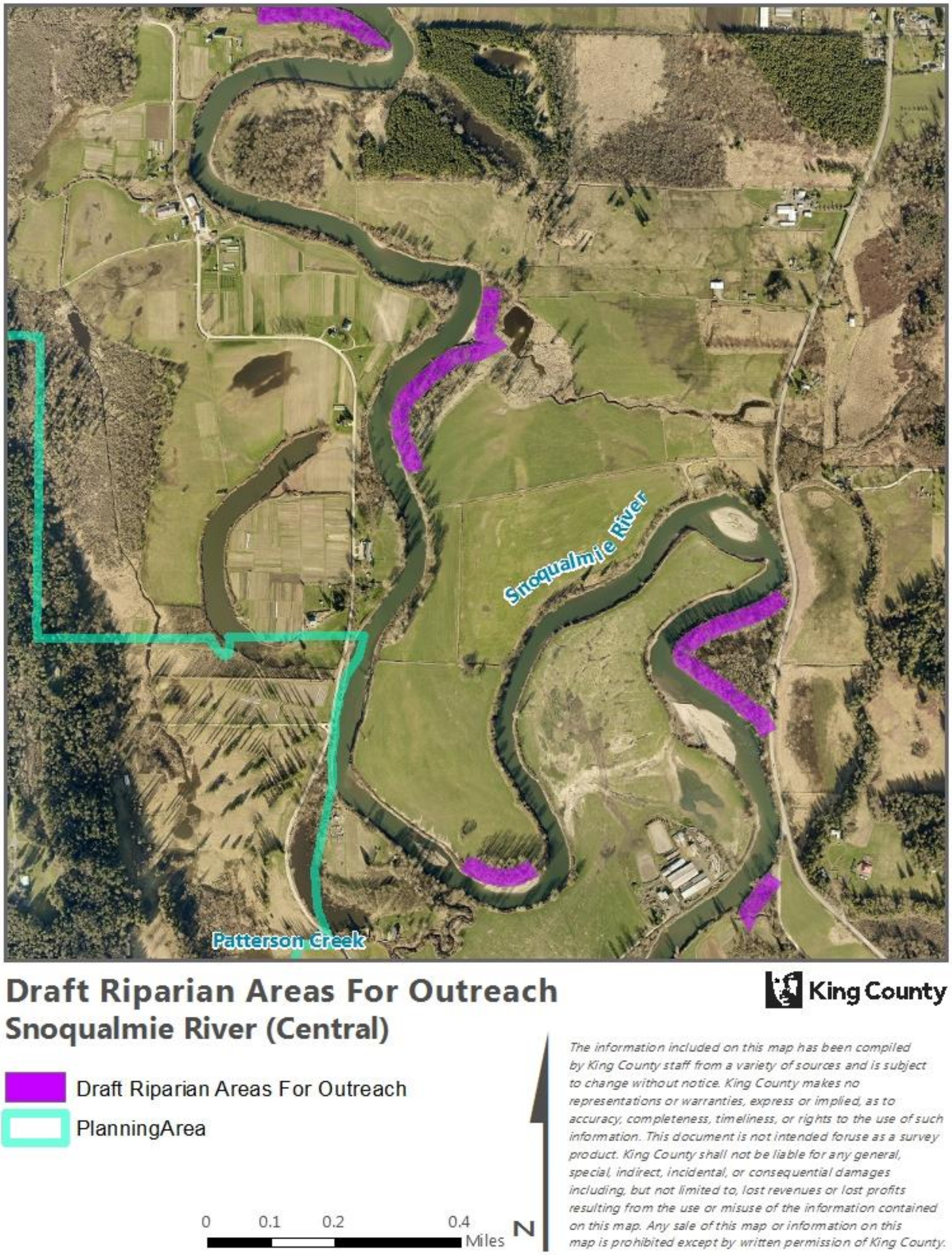

Figure 35. Riparian Areas For Outreach (Central)

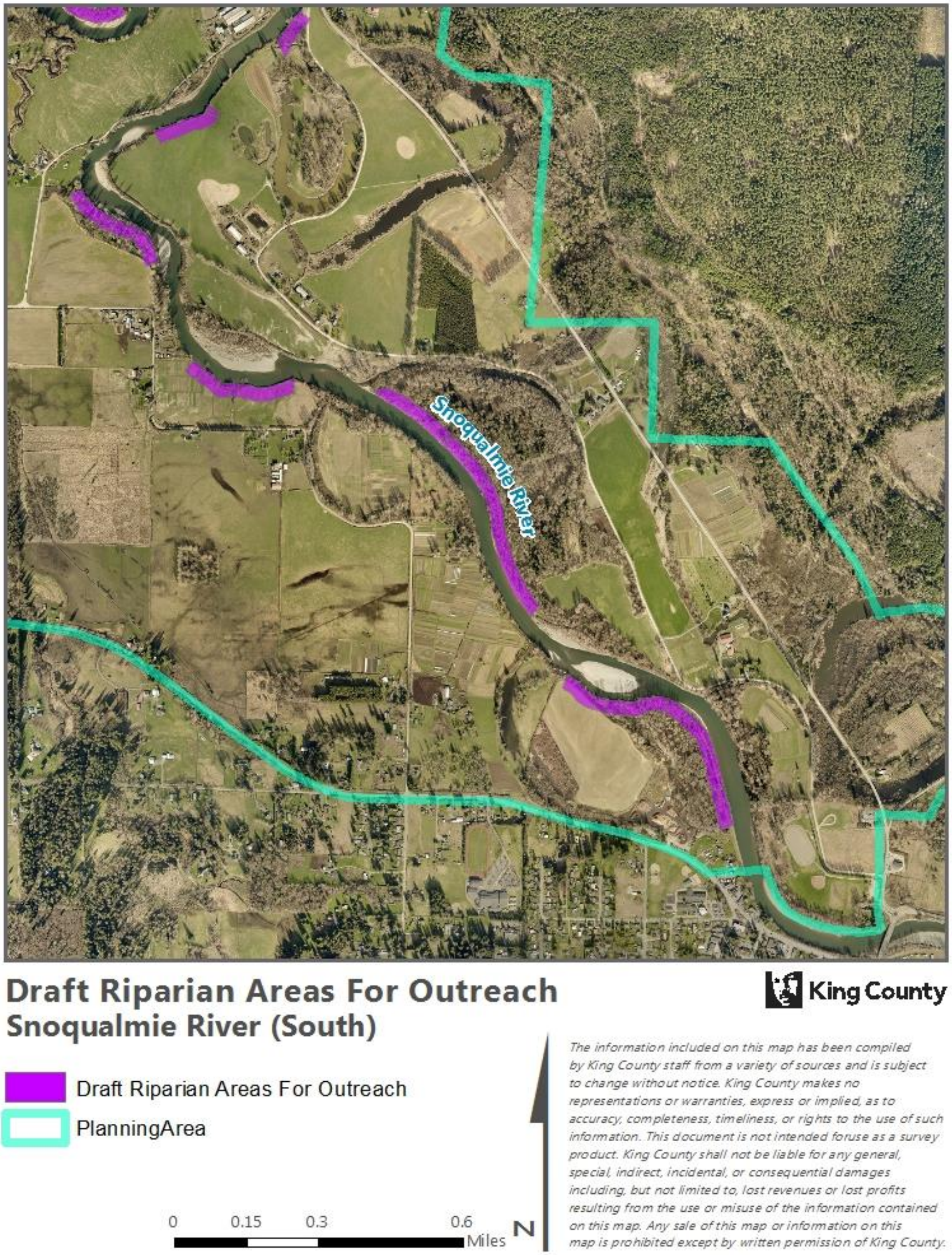

Figure 36. Riparian Areas For Outreach (South)

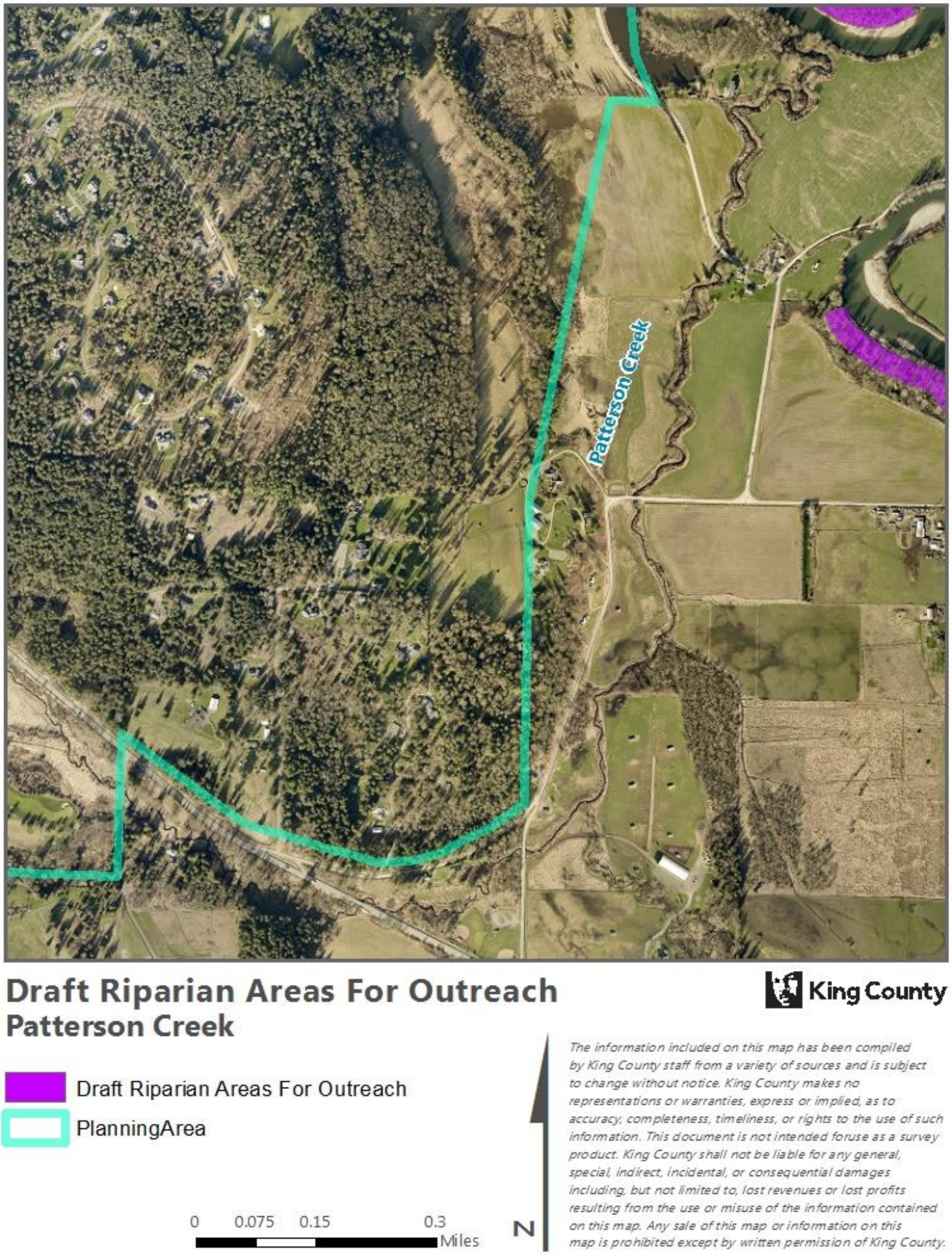

Figure 37. Riparian Areas For Outreach (Patterson Creek)

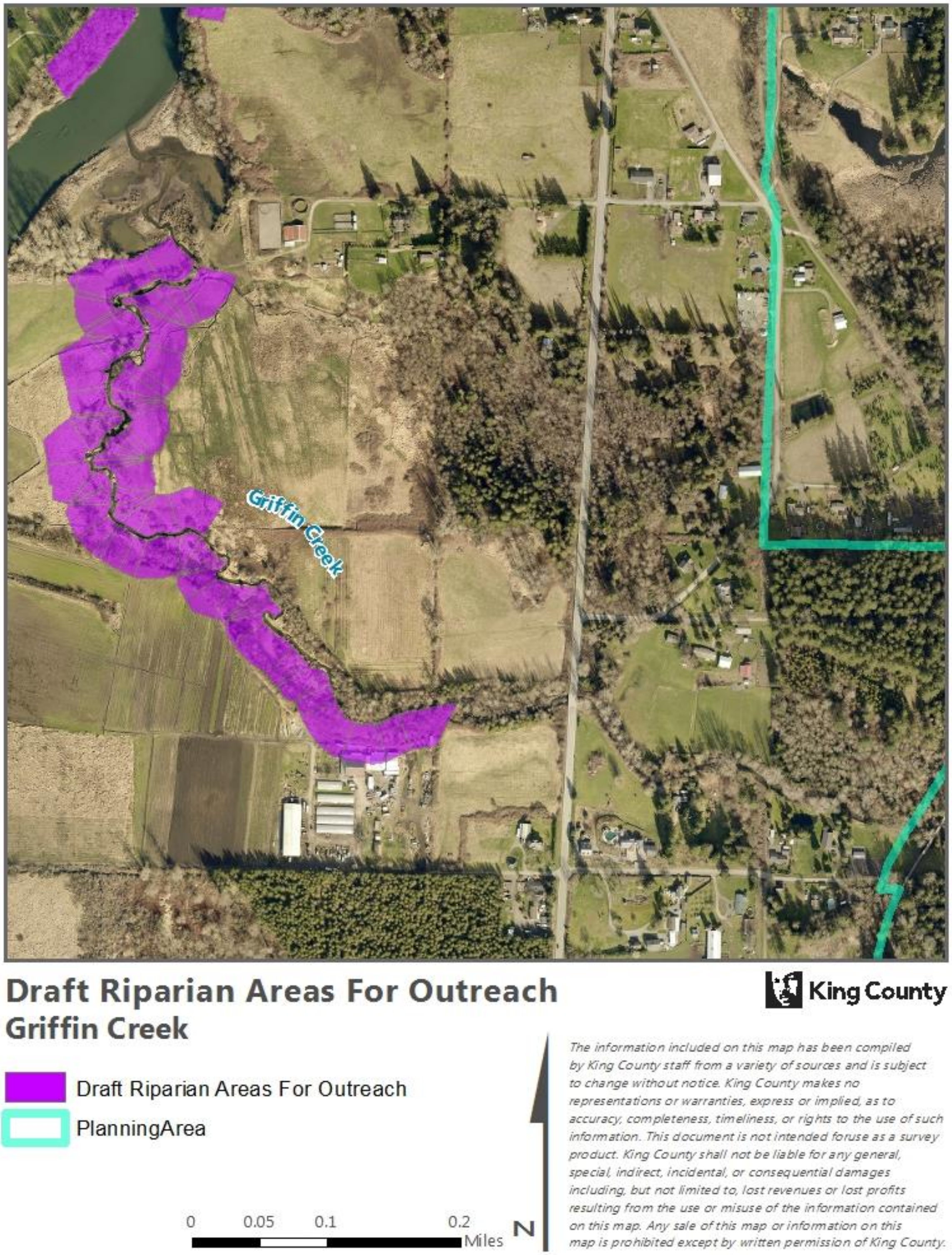

Figure 38. Riparian Areas For Outreach (Griffin Creek)

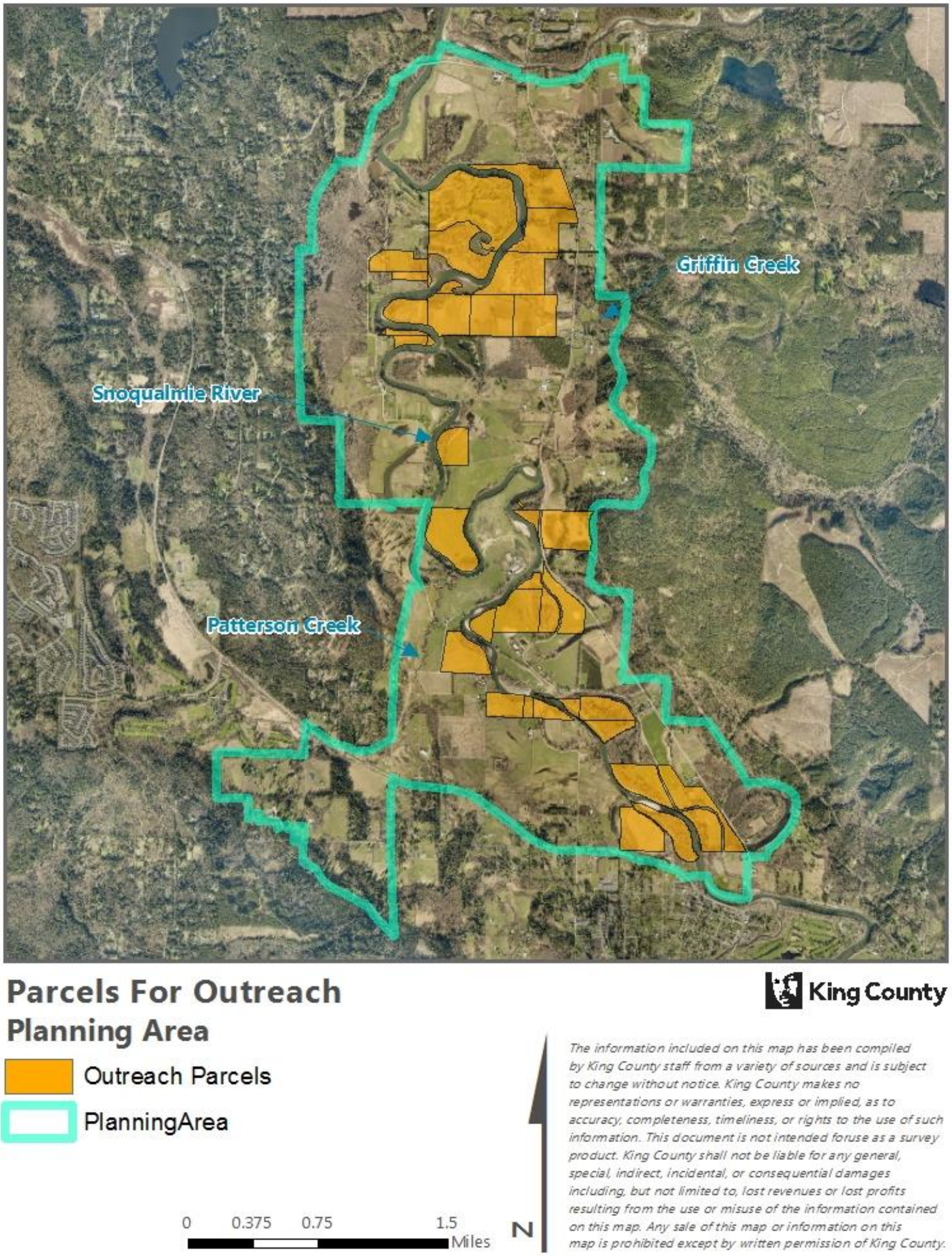

Figure 39. Parcels For Outreach (Planning Area)

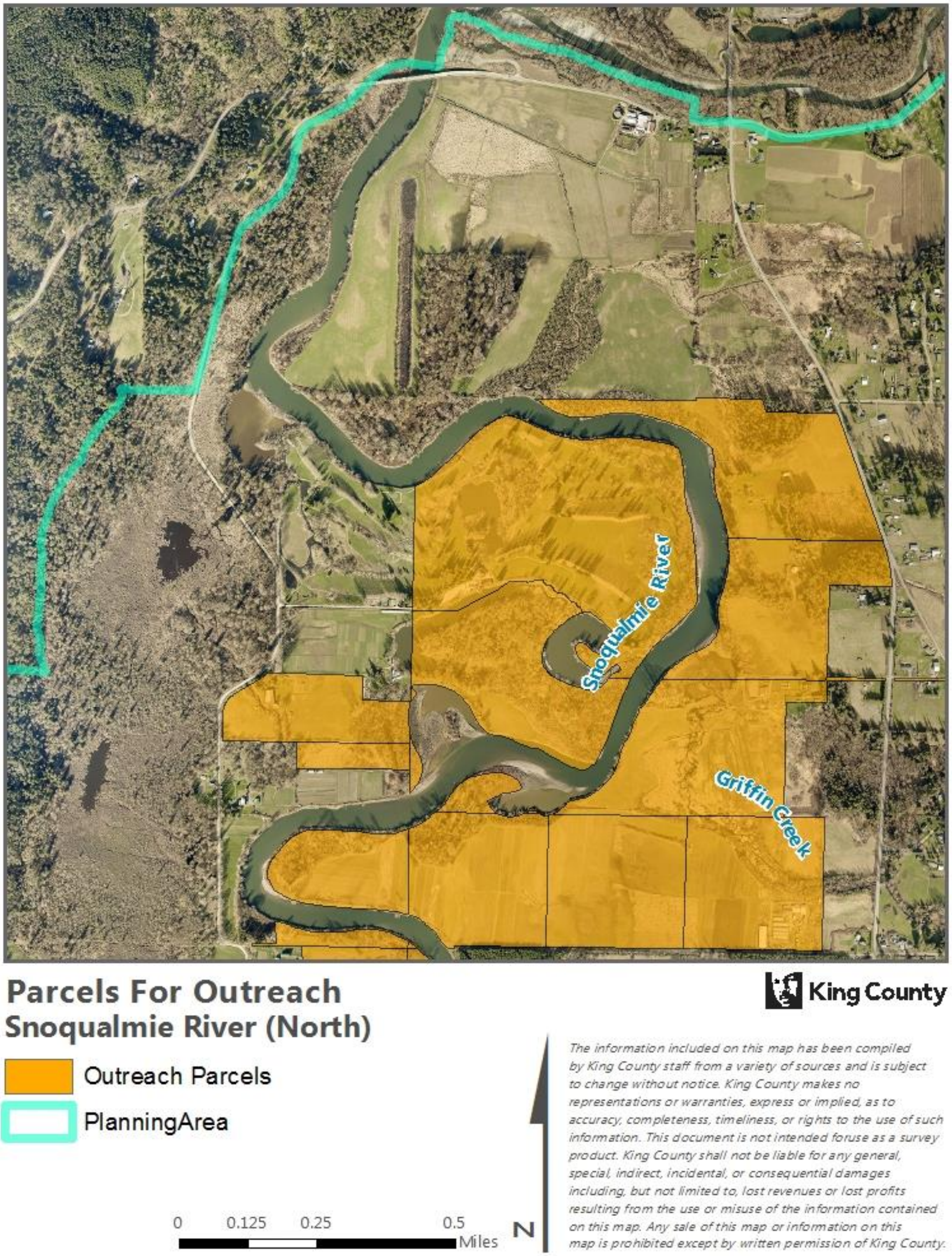

Figure 40. Parcels For Outreach (North)

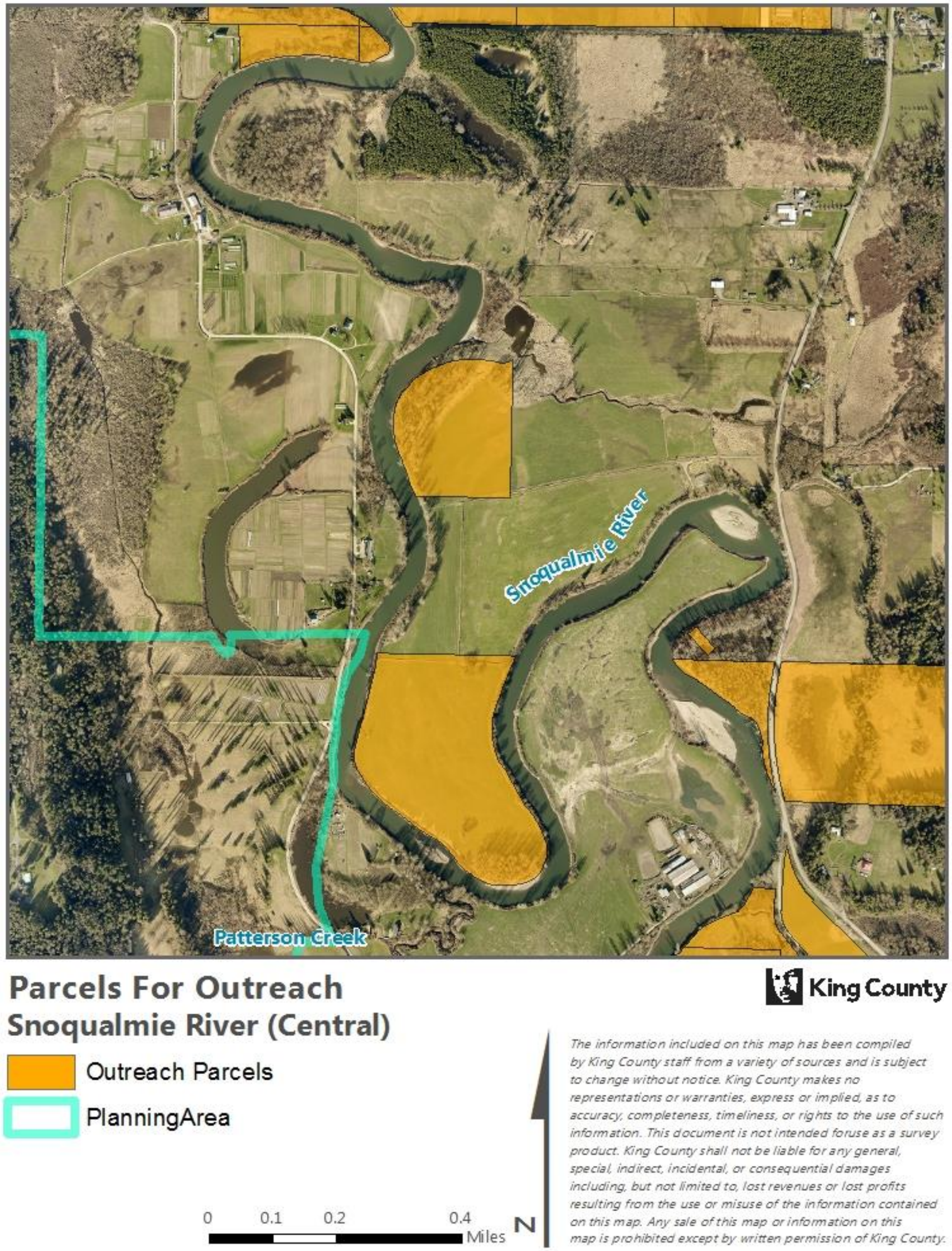

Figure 41. Parcels For Outreach (Central)

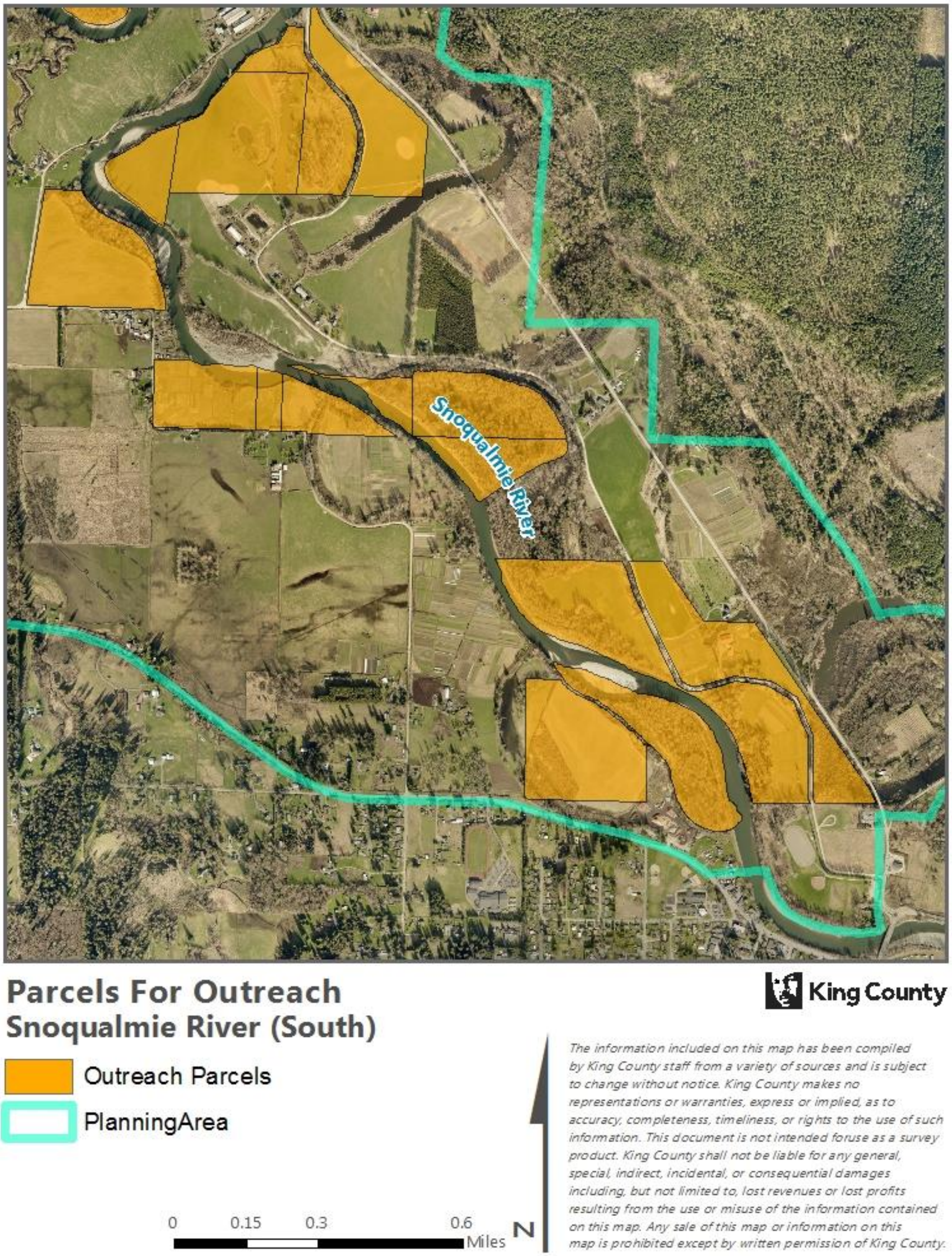

Figure 42. Parcels For Outreach (South)

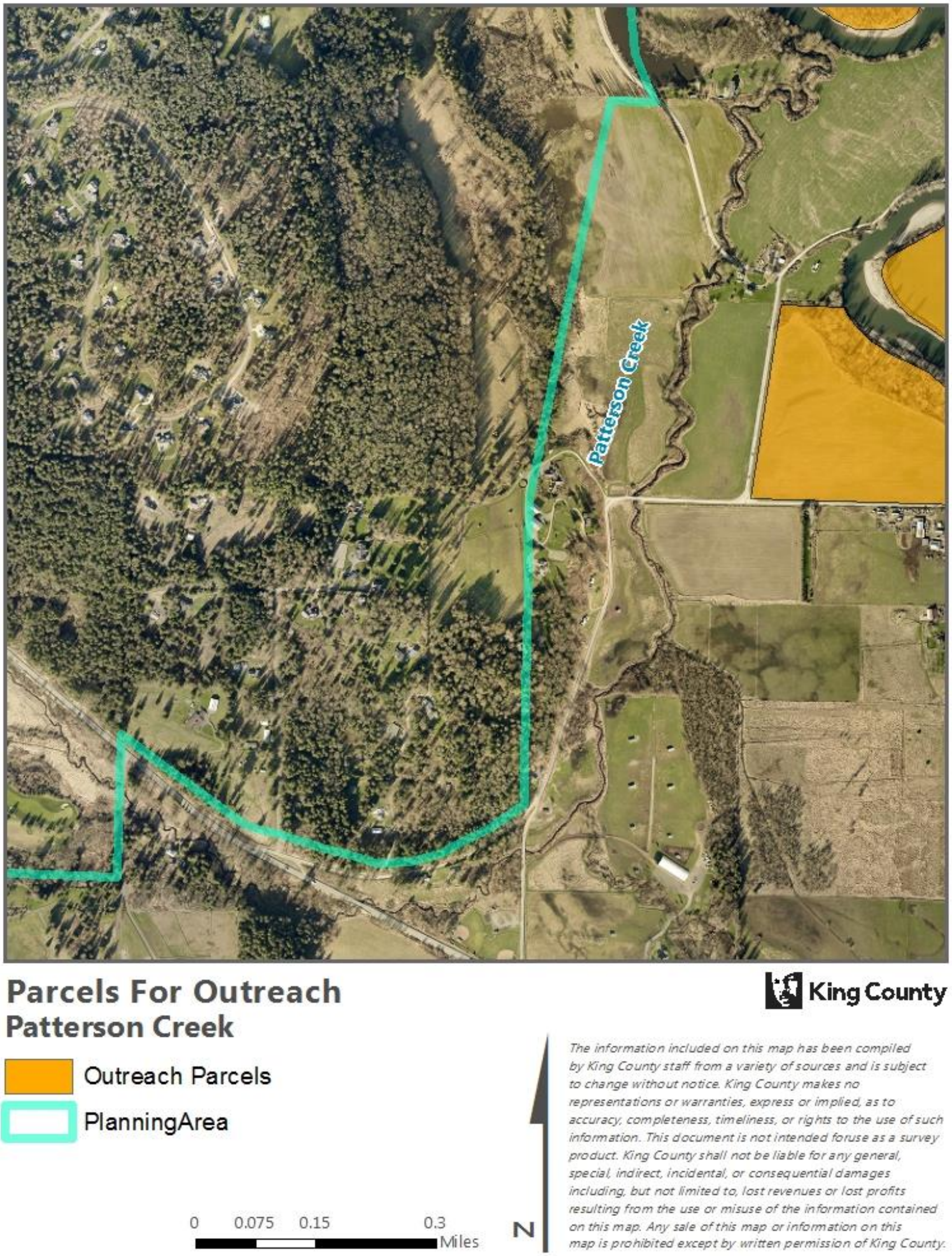

Figure 43. Parcels For Outreach (Patterson Creek)

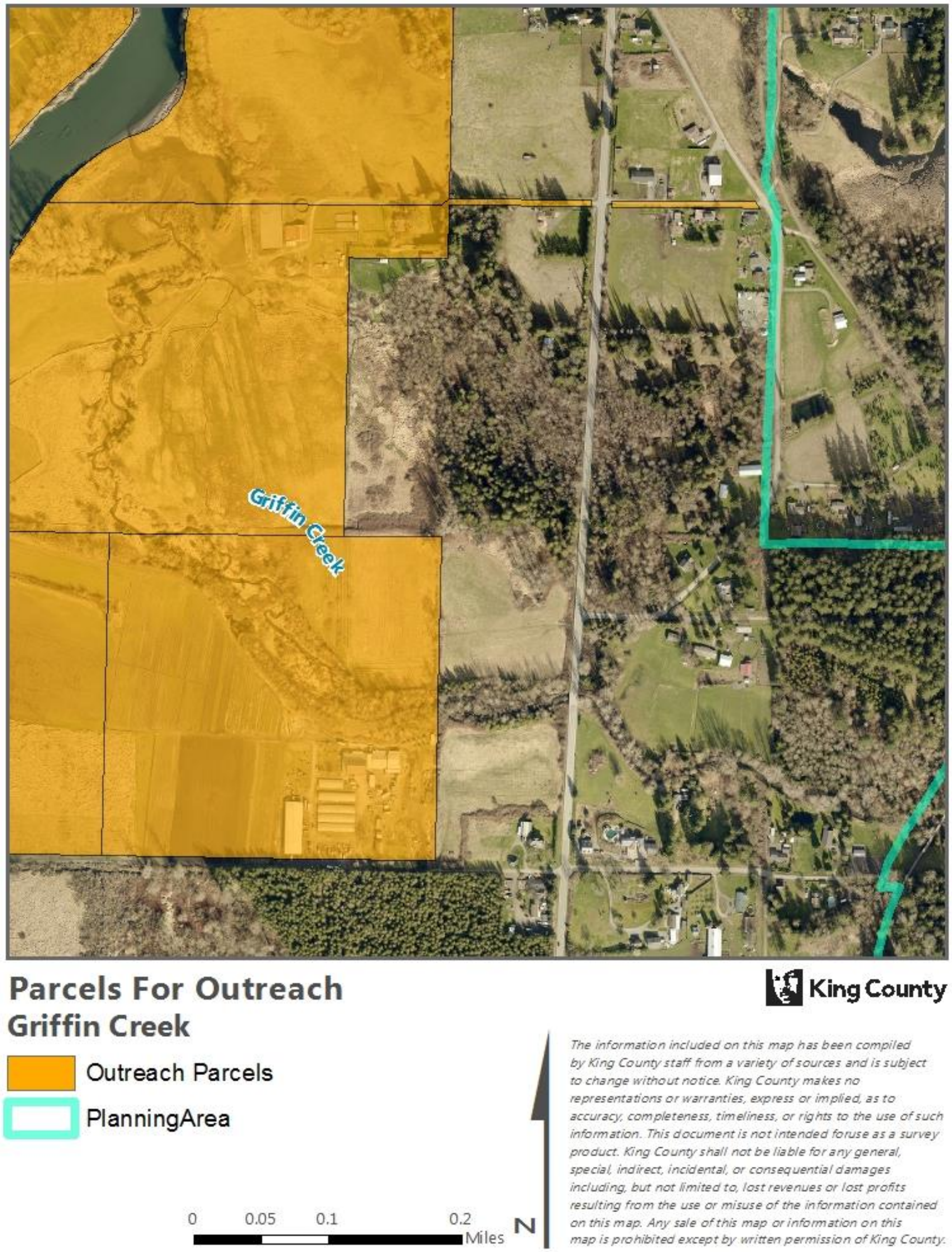

Figure 44. Parcels For Outreach (Griffin Creek)

10.0 REFERENCES

Collins, Brian D., Sheikh, Amir J, Feb 2002. Mapping Historical Conditions in the Snoqualmie River Valley (RM 0- RM 40). Department of Earth & Space Sciences, University of Washington. Seattle, Washington.

Fox, Martin, 2013. Riparian aspect priority for shade in the lower Green River. Prepared by the Muckleshoot Indian Tribe Fisheries Division. Auburn, Washington.

King County. 2014. The WRIA 9 Marine Shoreline Monitoring and Compliance Pilot Project. Prepared by Kollin Higgins, Water and Land Resources Division for the WRIA 9 Watershed Ecosystem Forum. Seattle, Washington.

King County, 2009. Snoqualmie Watershed Water Quality Synthesis Report. Prepared by Janne Kaje, Water and Land Resources Division. Seattle, Washington.

King County, 2016. Hot Water and Low Flow: The summer of 2015 in the Snoqualmie River Watershed. Prepared by Josh Kubo, Water and Land Resources Division. Seattle, Washington.

Lucchetti, G.*, J. Burkey, C. Gregersen, L. Fore, C. Knutson, J. Latterell, P. McCombs, R. Timm, J. Vanderhoof, and J. Wilhelm. 2014. Assessing land use effects and regulatory effectiveness on streams in rural watersheds of King County, Washington. Prepared by Water and Land Resources Division. Seattle, Washington.

Lucchetti, G., K. Higgins, J. Vanderhoof, 2014. A salmon based classification to guide best management practices for agricultural waterways maintenance. King County Water and Land Resources Division. Seattle Washington.

Northwest Hydraulic Consultants, 2006. Flood Insurance Mapping Study for the Snoqualmie River and Skykomish River King and Snohomish Counties. Prepared for Federal Emergency Management Agency.

Solomon, F. and Boles, M., 2002. Snoqualmie Watershed Aquatic Habitat Conditions Report: Summary of 1999-2001 Data. King County Water and Land Resources Division. Seattle, Washington.

Solomon, F. and Boles, M., 2004. Snoqualmie Watershed Stream Habitat Reconnaissance Report. King County Water and Land Resources Division. Seattle, Washington.

Snohomish Basin Salmonid Recovery Technical Committee, 2000. Snohomish River Basin Chinook Salmon Habitat Evaluation Matrix. Snohomish County Surface Water Management Division. Everett, Washington.

Snohomish Basin Salmonid Recovery Technical Committee, 2004. Snohomish River Basin Ecological Analysis for Salmonid Conservation. Snohomish County Surface Water Management Division. Everett, Washington

Snohomish Basin Salmon Recovery Forum. June 2005. Snohomish River Basin Salmon Conservation Plan. Snohomish County Department of Public Works, Surface Water Management Division. Everett, Washington.

Stohr, A., Kardouni, J., Svrjcek, R., 2011. Snoqualmie River Basin Temperature Total Maximum Daily Load: Water Quality Improvement Report and Implementation Plan. Washington State Department of Ecology. Bellevue, Washington.

WRIA 9 Implementation Technical Committee, 2012. WRIA 9 Status and Trends Monitoring Report: 2005-2012. WRIA 9 Watershed Ecosystem Forum. Seattle, Washington.

Appendix A: EMDS Handout

Riparian Health and Farmability
Initial Decision Model (EMDS) Discussion – Advance Overview of Policy Issues

November 16, 2016

Through an Ecology grant, King County (KC) in partnership with the King Conservation District (KCD) and the United States Forest Service (USFS) is testing an approach to multi-objective decision making known as the Ecosystem Management Decision Support system (EMDS). The methodology uses a logic model approach to organize data and roll that up for application of multi-objective criteria. Its intended use is towards progress on "wicked problems" – problems such as exist in the Snoqualmie Valley Fish Farm Flood (FFF) conversations where energetic progress in any one of the FFF areas could pose unintended severe consequences for one of the other FFF areas.

Over the past month, through several day-long work sessions, logic models have been pieced together for both riparian health (buffers) and farmability. The logic models were built toward identification of the best future for each of those topics. Now the application of the EMDS approach moves to weaving together the logic models into a decision model that can be used to set priorities. It is important to note that this is not an optimization model – optimization is not possible with wicked problems, only positive forward movement with minimized impacts.

Some background details are provided below and some emerging policy questions follow the background details. Please familiarize yourself with the background and the types of policy questions that may be discussed.

Background Information

1. The project reach includes the Snoqualmie River from the Raging River to the Tolt River as well as the reaches of Griffin and Patterson Creeks within the APD.
2. While the results of the logic model can be spread out to show a range of scores/value (high-medium-low), in actuality, all the riparian areas along the Snoqualmie are of high value in the Snohomish Basin Salmon Recovery Plan (which includes the Snoqualmie River). As far as the grant, the decision model is only helping prioritize where to start larger width buffer plantings (≥100 ft wide) in the short term; the larger goal is to look for actions that uplift agriculture as well (improved drainage for example).
3. The Snohomish salmon plan has 50 year riparian goals.
    - The main purpose of riparian restoration in the Plan is <u>not</u> to address temperature specifically or even water quality, but to reestablish - in the long term - the role that riparian forests play in overall river processes, i.e.,

sources of wood to form log jams that can stimulate migration, increase complexity, and create interconnectedness.
  - The plan defines the riparian zone as being 150ft wide. The supporting technical document (EASC) uses a minimum width of 130ft of mature forest to classify 'intact'. Any buffer widths less than 130ft **or** with immature trees (*roughly less than 150ft tall*) would be classified as still being in a degraded condition.
  - In focus reaches of the mainstem rivers, the plan calls for 80% of the riparian area to be intact (*this applies to the Snoqualmie River from the mouth of the Raging River to the mouth of Patterson Creek*).
  - In other mainstem river areas, the EASC calls for 76% of the riparian area along the mainstem rivers to be intact. As of 2005, 56% of the broader Mainstem riparian areas were intact—in the Snoqualmie Valley Agricultural Protection District (APD) the percentage of intact riparian area is much lower.
  - The Plan (page 5-14) states that other non mainstem river riparian areas on fish bearing waterways should be at least 65% intact. Furthermore, subbasins classified as having the highest coho use should have 80% of its streams having intact riparian areas (*Griffin Creek is the only stream in the study reach classified as having high coho use*). So, Patterson has a target of 65% intact and Griffin has a target of 80% intact.

4. Across the Snoqualmie basin, riparian areas are degraded to some degree or another, but the most severe degradation occurs within the APD.
5. The table following is just some basic contextual information on the Snoqualmie APD-based on 2013 Ag land use data. The "South" APD is the same as this project's study area. It should be noted that the Executive's Local Food Initiative includes a goal of increasing productive farmlands by 400 acres per year.

APD	% of APD	% in FPP	% of FPP in active Ag	% not farmable (does not include forested)	% in livestock or forage	% in market crops	% horse
North	65%	47%	92%	20%	51%	8%	9%
South	36%	11%	81%	37%	13%	10%	22%

6. Comp Plan policies, F.A.R.M.S. Report, Local Food Initiative Roadmap (citations in the regulatory task force – no science based information to date). However, once funded, the Snoqualmie Valley Land-resource Strategic Plan will have new information as categorized by the landowner/farmer. These soils are prime and the main concerns in this area are drainage, flooding, and bank erosion.

7. This project assumes the individual farmer is willing and is compensated for the value of any land dedicated to an easement. The 'impact' of a large buffer is not on the individual, but on the larger ag land resource.

Decision Model Policy issues to address at workshop.

1. Assuming there is a willingness to assign high, medium, and low values to both stream banks (riparian) and farmability (ag lands) can we consider larger riparian easements on lowest farmability value lands?

   Possible sub-questions

   a. Do we want to protect high valued ag lands from large easements regardless of riparian value?
   b. Should easements on lower value ag lands always have an offset when land is taken out of potential production?
   c. On low value ag lands, if productivity could be improved does that create a different answer to "b"? e.g., if a multi-land owner drainage project or water rights would change the ag land value, should it be moved to a higher "value" based on potential?
2. Is there a basic water quality best management practice strip of land or distance from the Ordinary High Water Mark that should not be counted against salmon recovery interests if it is removed from ag production? Put another way, should agriculture be farming up to the edge of the water? If not, how far back from the edge is the minimum best management practice?

   Below are several recommendations from related guidance documents/policies:

   a. KC CAO LMO-50ft fencing setback if no farm plan, 25ft reduction if have a farm plan.
   b. NRCS FOTG-460: clearing new land, minimum 50ft buffer from streams/wetlands
   c. NRCS FOTG-391. Water quality focus, minimum 35ft
   d. FPP-written policy-first 25ft (previous verbal guidance was 50ft) does not count against tillable surface limits
3. Practical issue on easements. Should easements focus on covering an entire parcel's riparian zone or on smaller stretches within a parcel that have the best combination of riparian and ag value?
4. FPP
   a. At the individual farm/parcel scale, what can we do in those areas per current FPP easement interpretation on the **old** FPP easements?
   b. Do the new TDR Ag easements have the same restrictions?

c. Is the DOE easement approach allowed/compatible with FPP easement? This question applies to both DOE and what their grant money may and may not pay for as well as applies to KC's interpretation of FPP deed language.
d. FPP at the broader scale of the whole APD. The project reach (southern APD) has relatively small amounts of FPP easements along the banks of the study area's focus waterways (7% of Snoqualmie, 29% of Griffin, 28% of Patterson). The northern APD has a larger amount of FPP easements along the Snoqualmie River (~41%) {note these numbers do not include newer TDR easements}. If we choose to say in question 4a above that there is no flexibility on specific older FPP easement properties, then this entire project reach becomes much more important to plant wide buffers on <u>all</u> properties irrespective of the riparian logic model score as the Salmon Plans riparian goals will be mathematically impossible to meet otherwise.

5. The ag logic model does not appear to address the many benefits of trees/riparian areas provide to farmers. It currently only accounts for trees that help reduce bank erosion. Shade is treated as only a negative on productivity when it can be a benefit to some livestock operations. Should the unaccounted for values be considered here? In addition, shade for livestock becomes limited when fencing can block livestock from accessing a considerable amount of shade. If approached thoughtfully, this could be a win.
6. How do we integrate into the logic results that we also want to do large scale aquatic habitat restoration projects in the project reach? Will the DOE easement constrain any future restoration actions that may cause the land covered by the easement to erode away? In the decision model, should potential large CIPs be seen as providing more rationale for picking a site (kick starting the eventual LWD recruitment and slowing erosion) or as a detriment to the plantings? We could use the draft GIS file created in FFF for where large aquatic habitat restoration projects are likely to occur, but this file has not been vetted with restoration interests. If FFF uses EMDS in the future, a new logic model should be developed for potential aquatic habitat restoration locations.
7. The riparian logic model does not currently address larger connectivity and the benefits of a continuous riparian buffer. Should the concept of connectivity/contiguousness be incorporated into the prioritization of different areas? This is related to bullet number 1.
8. Recent temperature data collection (2015 and 2016) points to a reach from Dan Beyer's farm to the outlet of Carnation Marsh as being an area with strong cool groundwater influence. Should this reach be prioritized over other areas to provide shade to the cold water source?

9. The Salmon Plan's structure puts a higher priority on restoration actions within the "focus reaches". The project area has one of these focus reaches. Should a higher priority be put on the Snoqualmie River from the Raging to Patterson?
10. Should buffer width be limited to a lower amount (less than 150ft) behind levees/revetments since the facility will limit LWD recruitment? So don't go above 100 feet wide in those areas if there are any associated impacts to Ag of doing so?

Appendix B: Mitigation Scope

Advance Mitigation for Agricultural Actions
Scope of Work

Statement of Purpose and Project Phases

The purpose of this effort is to:

1. Document current King County permitting approaches to establishing mitigation values for voluntary planting projects by private landowners in advance of the private landowner's need for the mitigation.
2. Explore alternatives to the current approach that may serve both private landowners and others creating habitat.
3. Recommend a repeatable method for providing mitigation credit for voluntary habitat plantings in the Snoqualmie Agriculture Production District (APD) that addresses both mitigation requirements and advances priority habitat improvements where possible.
4. Achieve the above three purposes through substantive dialogue with interested parties including tribes, landowners, nongovernmental entities, regulators and special districts.

The work will be conducted in two phases:

PHASE ONE: Document Current Approach

Document current King County practice of evaluating and determining mitigation value of voluntary plantings that occur before associated permit submittal. Current county and state code will be reviewed to establish intent. Current practice will be explored through review of issued permits and interviews with land owners, King County, and state regulatory staff. A summary of challenges related to the current approach as identified through interviews, will be provided. Approaches to further analysis of the challenges will be suggested.

PHASE TWO: Research and Analyze Alternative Approaches

King County is not the only jurisdiction to face challenges in the effort to create a regulatory environment where both agriculture and natural systems thrive. In this phase research will be conducted to identify jurisdictions around the world that have achieved or made substantial progress towards sustainability goals and the principles that have informed their actions. Alternatives will be explored with regulators and interested or affected entities for pros and cons of the various approaches.

PHASE THREE: Recommendation and Action Plan

A consensus recommendation will be developed and next steps identified to move the recommendation towards reality. Near term actions that could address existing challenges

will also be identified. Consensus on the recommendation will be achieved through the Fish Farm Flood 2.0 consensus process.

Project Team

Phase One would be led by a King County Department of Permitting and Environmental Review (DPER) Resource team staff member who specializes in Critical Areas and a regulatory specialist from King County Department of Natural Resources and Parks, Water and Land Resources Division (WLR), Agriculture Team. This team would work in coordination with the King County Agricultural Permit Team and King Conservation District (KCD).

Phase Two and Three would be led by the WLR Agricultural Regulatory Specialist. This effort may be folded into the work of the King County Fish Farm Flood (FFF) Initiative – 2.0 Implementation Committee (FFF 2.0) with the full complement of entities and stakeholders represented.

Timeline

TBD

Resources Needed

Staffing is available to complete Phase One within King County. Depending on the level of external interview and their relationship to other work underway, partner team members such as the KCD may need additional funding. Phase Two and Three may need additional staffing, depending on Phase One findings and the timing of initiating Phase Two and Three work.

Background and Problem Statement

Through the FFF process, recommendations were made to establish a mitigation system to predictably provide advance credit for voluntary buffer and wetland planting projects. FFF Action Item Number 24[1] tasks FFF to, "Appoint a group of farm, fish and regulatory experts to pursue the establishment of a clear advanced mitigation system for projects on the same property, so that a person who undertakes a voluntary planting on their property can get mitigation credit for it some years in the future." The recommendation is designed to create a win-win-win for fish, farm, and flood stakeholders by providing an option for farmers that want to expand their operations in the future but in the process may impact critical areas requiring mitigation. Because of the potential future need for mitigation, many farms have areas on their farms that have great potential as buffer planting/habitat restoration areas, but which would lose their potential use as mitigation if restored for habitat in advance of the potential future need. DPER has occasionally provided advance credit for

[1] See Fish Farm Flood Advisory Committee Final Report, Appendix 1, 2017 (Pending)

buffer plantings, however, farmers remain unclear about how to gain assurance that plantings today will result in future mitigation value.
Farmers are faced with multiple scenarios that have potential to benefit from clear mitigation options for a variety of environmental purposes. For the purposes of this scope of work, the focus will be on riparian buffers.

Scope of Work

The following is a list of the tasks, which are described below in more detail.

Phase One:

Task 1.	Research and document current DPER practices
Task 2.	Formalize documentation of current DPER practices
Task 3.	Establish communication plan for current practices

Phase Two:

Task 1.	Problem Statement Development
Task 2.	Analysis (potential need)
Task 3.	Relationship to Related Issues
Task 4.	Alternative Development
Task 5.	Alternative Analysis

Phase Three:

Task 1.	Recommendation and Action Plan

PHASE ONE:

Task 1. Research and document current DPER practices

The WLR Agricultural Regulatory Specialist will work with DPER staff, the KC Ag Permit Team and KCD to document current practices.

Deliverables:

- *Write up of current practices*

Task 2. Formalize documentation of current DPER practices

The KC WLR Agricultural Regulatory Specialist will work with DPER and WLR leadership to formally document and establish current practices (details to be determined)

Deliverables:

- *Leadership action taken to formalize current practices*

Task 3. Establish communication plan for current practices

The WLR Agricultural Regulatory Specialist will work with KC agricultural staff, the KCD and others to communicate to farmers and other farm landowners about how to work under current DPER practices.

Deliverables:

- *Communication plan established and implemented*

PHASE TWO:

Task 1. Problem Statement Development

The project participants will work together to provide a clear problem statement as well as to identify 3-5 types of agricultural actions that result in the need for mitigation and which in turn can be used for beta testing alternatives.

Deliverables:

- *Form a project team comprised of a group of farm, fish, and regulatory experts*
- *Identify the types of agricultural actions that result in required riparian mitigation*
- *Develop a problem statement*

Task 2. Analysis (potential need)

The Project Team will seek stakeholder input including landowners, the agricultural community, restoration interests, and regulatory agencies to analyze the potential need for a riparian mitigation framework. An emphasis will be placed on determining the regulatory framework that will be used to address the problem statement. The Project Team will identify what triggers mitigation and determine if a mitigation program is the best approach to promoting overall restoration of habitat and protection of farmland.

Deliverables:

- *Determine what triggers mitigation*
- *Hold outreach meetings to gain support and seek stakeholder input*

Task 3. Relationship to Related Issues

The Project Team will consider the relationship to related issues. Potential synergies and conflicts should be identified. The Project Team will explore the potential for a program that could be linked to ecosystem services, climate change or related efforts underway that might have the ability to generate annual payments to farmers. Related efforts that may have the potential to affect the timing of completion of this work, (including but not limited to the Salmon Recovery Plan updates, FFF buffer and regulatory task forces, the FFF-recommended agricultural land strategy, and the Land Conservation Initiative) will be considered. Analysis will include consideration of the unintentional creation of perverse incentives.

Task 3.1 Research programs that are implemented through other counties and local jurisdictions as well as globally. Compare and contrast mitigation approaches and plantings in agricultural areas generally.

Deliverables:

- *A summary of other similar or instructive types of programs with lessons learned*

Task 4. Alternative Development

Once initial analysis of potential need is determined, the relationship to related issues has been considered, and other similar or instructive types of programs have been studied, the Project Team will reconvene to work through the issue in more depth.

Step 1. Make sure the appropriate agencies are included in the discussions and review process.
Step 2. Brainstorm possible ways to address the problem.
Step 3. Discuss pros and cons of possible approaches, including feasibility, and develop preferred solution.
Step 4. Solicit review by all applicable agencies, interested members of the FFF, landowners, the agricultural community, and regulators, and take comments into account.
Step 5. Reach agreement on a solution and willingness to support the concept through implementation.
Step 6. Agree on an implementation strategy; Project Team works to implement; FFF stakeholders review project team's work and products as needed.

Deliverables:

- *Draft Alternative Development Report*
- *Comment/Tracking response document*

Task 5. Alternative Analysis

The Project Team will compare and contrast alternative approaches to the development of a mitigation system to transparently provide credit for voluntary buffer and wetland planting projects. The Project Team will consider synergies with current County (and other) programs to determine if other programs should be consulted or integrated into the mitigation effort. Review will be solicited from applicable agencies, interested members of the FFF, landowners, the agricultural community, and regulators.

Deliverables:

- *Draft Alternatives Analysis Technical Memo. Includes initial documentation of the alternative development, with descriptions of the alternative approaches evaluated.*
- *A compilation of input received and action taken as a result of input.*
- *Final Alternatives Analysis Technical Memo. Includes documentation of the alternative development, with descriptions of the alternative approaches* evaluated. The analysis related to effects on agricultural lands and considerations for each alternative will also be shown.

PHASE THREE:

Task 1. Recommendation and Action Plan

A consensus recommendation will be sought from the FFF 2.0 committee. Once consensus has been achieved an implementation plan will be developed that clearly articulates next steps and provides a preliminary estimate of program cost to set up and maintain, as well as the need for public engagement, regulatory pathways (Including lead agency recommendation), tracking mechanisms, and other tasks needed to successfully launch such a program.

Deliverables:

- *Recommendation and Action Plan Technical Memo*