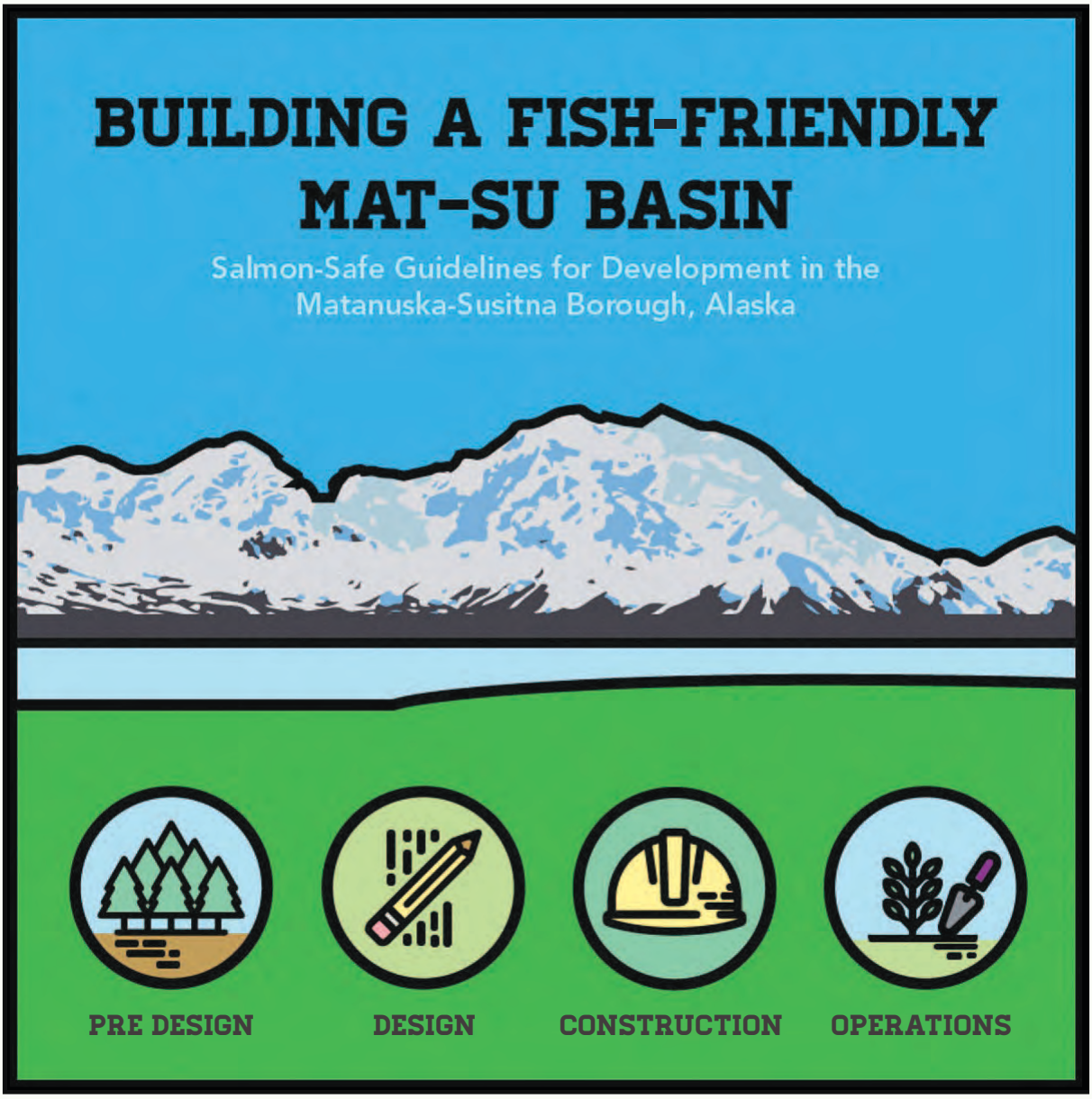
BUILDING A FISH-FRIENDLY MAT-SU BASIN

Salmon-Safe Guidelines for Development in the Matanuska-Susitna Borough, Alaska



Prepared for
The Nature Conservancy

Prepared by Salmon-Safe

SALMON SAFE

Technical Consultants

Herrera Environmental Consulting, Inc.
Sustainable Design Group, LLC

Building a Fish-Friendly Mat-Su Basin

Salmon-Safe Guidelines for Development in the Matanuska-Susitna Borough, Alaska

Prepared for

The Nature Conservancy in Alaska
715 L Street, Suite 100
Anchorage, AK 99501
Phone: (907) 865-5700

Prepared by

Salmon-Safe Inc.
1001 SE Water Ave, Suite 450
Portland, OR 97214
Phone: (503) 232-3750

Technical Consultants

Herrera Environmental Consultants, Inc.
2200 Sixth Ave, Suite 1100
Seattle, WA 98121
Phone: (206) 441-9080

Sustainable Design Group, LLC
247 S Alaska Street
Palmer, AK 99645
Phone: (907) 745-3000

June 2018

Table of Contents

Introduction

Wild salmon are an integral part of Alaska's history, culture, community and economy. Salmon have been vital to Alaskan life and culture for thousands of years and they continue to be the lifeblood of Alaska's economy and way of life. As population growth and development continue within the Matanuska-Susitna (Mat-Su) Borough, it is critical to plan for sharing increasingly urbanized areas with the salmon populations found in the rivers and streams throughout the Matanuska and Susitna River basins so that the Mat-Su can enhance rather than diminish its way of life.

Since 1997, **Salmon-Safe** has successfully defined and promoted ecologically sustainable development and land management that protects water quality and habitat at sites in the Pacific Northwest. These guidelines are a collaborative effort with **The Nature Conservancy (TNC)** and other Alaska-based partners to engage developers in the Mat-Su in exploring how these environmentally innovative practices can be applied across projects in the Mat-Su and at all scales of development. Through thoughtful site planning, implementation of low-impact design solutions and materials and careful maintenance practices, land development and redevelopment can contribute to the conservation of the Mat-Su watershed. Salmon-Safe recognizes this and seeks to inspire developers working on residential projects, commercial buildings, streets, parking areas, utility infrastructure and landscape areas to protect the extraordinary habitat values of the Mat-Su Basin.

Figure 1. Juvenile salmon use stream habitat for rearing and protection.
Source: *B. Blaud, Herrera Environmental Consultants, Inc.*

This document, prepared in collaboration with **The Nature Conservancy**, aims to help developers and land use planners create communities in the Mat-Su Borough that support healthy people and salmon. Existing development regulations provide some basic levels of protection for salmon and their habitat, but many have not been updated to address the rate of population growth and development occurring in the borough.

This document describes many of the potential effects of development on salmon and salmon habitat and presents guidelines for development within and near salmon habitat in the borough that extend beyond existing regulations to better protect salmon. After a detailed gap analysis effort between Salmon-Safe standards and Mat-Su codes, a set of Mat-Su-specific above-compliance strategies were identified to protect the watershed for the benefit of salmon. The guidelines are based on the best available science and best practices, as well as existing Salmon-Safe standards and have been developed to be practical and economical for development in the Mat-Su Borough.

Why Mat-Su Development Matters for Salmon

The Mat-Su Borough is one of the fastest growing communities in the US. From 1990 to 2000, the population grew at a rate of 49 percent, nearly four times the statewide growth rate of 13 percent. Based on the 2016 United States Census, the population was 101,095 as of March 2016. The Mat-Su Borough has barely enough housing units for its residents (Valley Board of Realtors and Mat-Su Borough, 2015), and requires more development to support the projected population growth.

Pioneer Peak, Alaska

At 24,078 square miles, the Borough is approximately the size of West Virginia and contains numerous lakes and streams with resident and anadromous fish, including all five Pacific salmon species. Approximately 650 square miles of surface water, comprised of lakes, streams and open waterways, are found in the Mat-Su Borough (Source: U.S. Census Bureau). In 2015, sport fishing attracted an estimated 59,000 anglers who spent 189,000 angler days fishing in Knik Arm and Susitna River drainages of the borough (ADFG 2017c). Visitor expenditures related to recreational water resources in Mat-Su also contribute to the local economy (Berman and Armagost, 2013).

In the Mat-Su Borough, stormwater traditionally has been treated more as a drainage issue than a water quality concern and is not regulated in the Mat-Su Borough Code. In the cities of Wasilla and Palmer, developers are responsible for minimizing runoff into adjoining streets, properties or wetlands, streams, or lakes with minimal treatment prior to entering wetlands, streams, waterways or lakes. Within unincorporated areas, stormwater is generally directed into road rights-of-way via ditches and culverts and conveyed into local waterways or drainage basins. Poorly designed drainage collects in low areas, collecting contaminants and causing road damage, glaciation and related maintenance issues. Repairs to poorly designed and constructed drainage use a large portion of Borough and Road Service Area budgets. The Mat-Su Borough Stormwater Management Plan highlights stormwater related issues within the Mat-Su Borough and sets goals that focus on community engagement, water pollution prevention, site runoff control and public sector control (USKH and Tetra Tech, 2013).

Ecosystems that coincide with more developed areas of the Mat-Su Borough may become seriously degraded without human intervention. Reduced health of these ecosystems is linked to alteration of native riparian vegetation, degraded water quality, and water flow changes, all of which have reached levels that may impair these ecosystems in the long-term.

- Potential effects from development on fish and fish habitats should be evaluated to improve existing regulations that better protect salmon.
- For development occurring within and near watersheds, guidelines to identify best practices appropriate to local conditions should be implemented. Modification to the proposed guidelines will evolve based on an understanding of the local environment.
- Development locations adjacent to habitat and open waters may require additional protection or techniques that reflect proven scientific methods that will enhance fish habitat.
- Where salmon counts indicate reduced numbers, identifying at-risk waterways supporting specific species can assist with targeting locations where initial actions can address critical needs.
- Major fish corridors should be assessed for alteration to native riparian vegetation, degraded water quality and water flow changes. An analysis will determine locations that have reached impaired ecosystems levels, habitats that have been compromised, and locations that are at potential risk.
- It is highly recommended that the MSB conducted an inventory and analysis existing riparian conditions to assist in identifying areas of critical concern.

Development Impacts on Salmon

One of the largest threats to salmon populations is habitat loss, a common side effect of development near streams and water bodies. Our scientific understanding of salmon freshwater requirements has increased in recent years and continues to grow as scientists examine the impact of urbanization on salmon. Salmon habitat requirements include: (1) good water quality; (2) appropriate water quantity; (3) instream and riparian (streamside) habitat and (4) fish passage. Each of these components represents important features for supporting salmon populations.

Stream Health and Function

Water quality needs depend on the species and life stage. In general, salmon require cool, clean, flowing water that is free of pollutants. Development can affect water quality by increasing impervious surfaces (hard surfaces such as parking lots and roofs), introducing pollutants such as fertilizers used in landscaped areas and removing riparian vegetation that provides natural cooling and prevents sediment from entering streams.

Water quantity refers to the amount of water and water flow in a stream. This flow is important, because salmon have maximum velocities (speeds) and minimum flow depths that will allow them to migrate or spawn, depending on the species and life stages. Development can affect flow by creating impervious surfaces that increase the quantity of water that directly enters a stream channel through surface runoff as well as wetlands that provide rearing habitat and warm water refugia that provide overwintering habitat. This changes the timing and volume of flows in the stream channel. Increased flows to streams also can affect water quality by causing erosion of the streambanks or channel incision. When eroded material settles to the bottom of a stream, it can cover gravel used for spawning, suffocate salmon eggs and destroy food sources for fish. Development can also have an adverse effect on waterways when summer groundwater withdrawals lead to reduced stream water depth and higher stream temperatures.

Instream and riparian habitat refers to habitat-forming features such as logs, aquatic vegetation and diverse substrates, such as gravel, cobbles, boulders and bedrock. These features benefit salmon by providing cover and creating spawning or refuge areas, such as pools and side channels. Development affects instream habitat by (1) removing vegetation along the stream banks that provides forage material, fish cover and water temperature control; (2) encroaching on naturally eroding stream banks and changing the landscape that would otherwise contribute to the stream channel; and (3) reducing sources of large woody debris, such as fallen trees and branches that would otherwise end up in streams.

Habitat connectivity is another essential component of salmon habitat because it allows salmon to move through streams to access various kinds of habitat for feeding, juvenile salmon growth and spawning. Development often creates barriers to fish passage that are physical (i.e., dams and improperly sized culverts) and non-physical (i.e., high water temperatures or low dissolved oxygen levels). Barriers to fish passage may render spawning grounds and other important habitats inaccessible to returning salmon as well as juvenile salmon known to make large movements upstream and downstream to overwintering habitats.

Development Impacts on Stream Habitat

Streams and wetlands support the spawning and rearing portions of the salmon life cycle and are extremely important to developing healthy populations. Salmon have different habitat requirements depending on their life stage. Newly emerged salmon fry require safe, slow moving waters with refuge from predators. Rearing salmon rely on wetlands for food and protection from predators. During migration, juvenile salmon require consistent passage as they travel from the upper watershed to the estuary and out to the ocean. Spawning adult salmon require gravel substrate that is free of fine sediments to protect developing eggs.

This section describes how development practices can adversely affect the habitat components described above. Development has profound impacts on salmon habitat, many of which are multifaceted. Salmon rely on freshwater habitat for numerous stages of their life cycle, including over-wintering, spawning and migration, as well as for feeding. For example, impervious surfaces, like roads and buildings, affect stream hydrology (such as flows) and water quality. Construction of culverts can create passage barriers and increased flows resulting from development can also destroy redds (salmon nests) with incubating salmon eggs. The types and components of development-related impacts on habitat are described below. Fish-friendly practices that avoid or minimize such impacts are described in the "Fish-Friendly Development and Salmon Protection" section of this document.

Figure 2. Stormwater retention for erosion control.

Source: *SDG, LLC*

Domestic Water Sources

Water withdrawals from surface or groundwater have the potential to adversely affect salmon habitat, primarily by reducing instream flows. Impacts can be minimized by (1) selecting alternative water sources that do not reduce instream flows; (2) by reducing the use of water; (3) by harvesting rainwater (see Figure 2); or (4) by reclaiming gray water from buildings.

Land Disturbance

Sediment delivery into salmon-bearing streams is a major cause of habitat degradation, particularly for salmon spawning areas. Stream bank erosion and upland surface soil erosion are the main sources of fine sediment, which can fill the interstitial spaces in redds to reduce hatching success and can abrade and irritate fish gills, leading to increased stress and mortality. Effective erosion control design and maintenance practices can prevent erosion and capture sediment before it leaves the site.

Pollution

Salmon survival depends on clean water, free of harmful levels of chemical inputs, fertilizers (nutrients), pesticides, stormwater runoff pollutants and organic waste. These contaminants can travel long distances in stormwater runoff from a development to receiving streams. The main methods to avoid contamination of salmon-bearing waters are (1) minimizing overall inputs of contaminants; (2) restricting the number of type of inputs, and (3) developing an acceptable application method through a comprehensive management program, such as an integrated pest management (IPM) plan.

Vegetation Removal

Wetland filling, clearing trees, shrubs and other vegetation in riparian corridors, wetlands and other areas affects habitat in many ways. Vegetation, for example, helps stabilize slopes; removing it contributes to erosion which, in turn, affects water quality and physical habitat features. Tree removal reduces the main source of large woody debris in streams. Because streamside vegetation shades the stream, it helps ensure water temperatures are cool enough for salmon. Measures should be taken to protect areas closest to surface water bodies—riparian corridors and wetlands.

Beyond the stream corridor, traditional development practices can impair ecological function critical to birds, bats and pollinators by eliminating habitat patches or corridors that provide food or shelter. Although few copiously urban areas exist within the MSB, it is important to note that small patches of habitat can aid species movement, provide temporary refuge for urban wildlife and can assist in stormwater management, especially when connected. These spaces and corridors provide interaction with the natural world while enhancing wildlife and salmon habitats we seek to protect. Improving urban ecological systems helps protect water quality by restoring soils, vegetation and ecological function in areas contributing to receiving waters within the watershed. A watershed is like a city for a fish and, at each life stage, salmon find their unique habitat needs in different parts of the watershed. Even small patches of urban habitat can aid in species movement and provide temporary refuges for urban wildlife. They also benefit borough residents by providing access to nature and additional amenity zones plus increased property value.

Stormwater

Precipitation (i.e., rain and melting snow) that does not infiltrate to become groundwater or return to the atmosphere via evaporation and transpiration becomes surface runoff (referred to here as "stormwater"). Roads, sidewalks, buildings and other impervious surfaces reduce the amount of land that naturally infiltrates rain or snow (see Figure 3, next page). As a result, water flows and drainage patterns change significantly. Instead of infiltrating surfaces, stormwater flows across surfaces and collects pollutants such as fertilizers, motor oil, sediments, pet waste, litter and debris, and transmits them to streams, lakes and waterways.

Stormwater can also become concentrated, creating drainage, flooding and erosion problems. To prevent the flooding of homes, businesses and local roads, stormwater runoff is often diverted into ditches and piped storm

Figure 3. Natural and developed watershed hydrologic regimes.
Source: *Hinman 2012*

drainage systems. Stormwater draining to streams from ditches tend to be warmer in temperature than it would be if infiltrated as groundwater, creating another water quality concern.

High levels of impervious surface and drainage systems from roads, parking lots, buildings and walkways contributes to flooding and increases the magnitude and frequency of peak flows in streams, which can degrade stream habitat. Stormwater from developed landscapes also contains contaminants such as oils, heavy metals, pesticides and fertilizers that degrade water quality.

Fish-Friendly Development and Salmon Protection

The Mat-Su Borough is one of the fastest growing communities in the country. Based on the 2016 United States Census, the population was 101,095 as of March 2016. The vast majority of units are single-family homes on large lots in suburban subdivisions located in a major residential area bounded by Big Lake, Houston, Sutton, Butte., Palmer and Wasilla, known as the Mat-Su Borough (MSB) Core Planning Area. The Mat-Su Borough does not track or issue economic indicators, such as permits for most development (Allen, 2014). Overall, there is a low vacancy rate—not enough housing to meet demand and a lack of rental properties and affordable units (Allen, 2014). These challenges related to growth in the Mat-Su Borough are common to many growing areas of Alaska. The Mat-Su has an opportunity to guide future development with salmon in mind. Formerly rural areas rapidly transitioning to urban or suburban development patterns are stressed in terms of providing adequate transportation facilities and other public facilities (Kostelec, 2016).

Development and Infrastructure Needs

Projected Mat-Su Borough population growth, combined with the general lack of housing, suggests that the rate of residential development will increase. The percentage of higher-density single-family and multi-family units will likely increase to provide more affordable housing options. Commercial development also will likely increase to provide goods and services to the growing population. Infrastructure, including roads, utilities and other public facilities, will be built to serve the new homes and businesses.

Developers will play an important role in meeting the needs of this growing population, including housing, transportation infrastructure, and industrial and commercial development. The development practices described in this section can help guide development in ways that reduce impacts on salmon habitat while providing economic benefits.

The Value of Salmon-Friendly Development

Property Value

Even aside from the ecological benefits of fish-friendly development practices, proximity to open spaces and salmon streams also enhances property values. According to Berman and Armagost (2013), proximity to open spaces and salmon streams is a significant contributor to real estate market prices. Properties near Denali National Park had much higher sales prices than others, and property values have been observed to decline about 5 percent per kilometer distance from the nearest salmon stream. The study estimates that local salmon streams contributed about $25,000 to the market value of a typical residential property sold in 2009 and 2010; lakes contributed about $12,000; and frontage on protected open space increased property values by 17 percent. The estimated total contribution of all the natural amenities considered was about $33,000,

presenting 44 percent of market value. Property frontage on the Matanuska River, however, has a strong negative effect on property values (a 41 percent loss) because the river has been eroding its banks in some areas, having swallowed several structures on riverfront properties in recent years (*Berman and Armagost*, 2013). Furthermore, market analysis in the Pacific Northwest indicates that environmentally innovative development (and particularly projects that achieve third-party certification) enhances residential and commercial property values. According to Earth Advantage (2015), areas in Western Washington showed a significant market reaction to environmental certification for new development, with sales premiums ranging from 4.5 to 8 percent. This is consistent with the 5 percent premium for certified homes in California reported by Earth Advantage. On the cost side, it's important to note that more ecologically sustainable projects can be built for the same cost as (and sometimes less than) conventional projects, particularly for fish-friendly development that infiltrates stormwater on site rather than relying on costly off-site delivery (USGBC, 2016).

Examples of the Economic Benefits of Fish-Friendly Stormwater Design

(EPA, 2012)

- Adding roadside bioswales, making roads narrower and designing smaller or porous parking lots with on-site runoff retention saves money by reducing the amount of pavement, curbs and gutters needed.
- Disconnecting roof downspouts and incorporating bioretention areas to capture on-site runoff from impervious surfaces (driveways or streets) saves money by eliminating the need for costly runoff detention basins and pipe delivery systems.
- Designing more compact residential lots saves money by reducing site grading and building preparation costs, and can increase the number of lots available for sale.
- Preserving large trees and other natural features can increase the value and sale price of residential lots.
- Using existing trees and vegetation saves money by reducing landscaping costs and decreasing stormwater volume.

Socio-economic Value

In addition to typical questions to borough residents about borough services and facilities, taxation, crime and other relevant community topics, the Matanuska-Susitna Borough Community Survey of 2014 (Chamard et al., 2014) included questions about salmon, open space and the environment. Overall, survey respondents had positive views about salmon and their contribution to life and the economy in the Mat-Su Borough. They were also likely to agree or strongly agree with statements supporting environmental protection and management. Respondents were asked to rank seven items based on their importance to their own health. Clean drinking water was ranked as the most important factor contributing to health by 53.7 percent of the respondents, followed by air quality, which was ranked as the second most important factor by 38.9 percent. When asked about involvement with fishing for subsistence or commercial purposes, more than two-thirds of survey respondents reported fishing for salmon for family food in the past year, while far fewer were involved directly or indirectly in a commercial manner. About one-third of the respondents eat salmon at least once a week or every day, with similar numbers reporting having eaten salmon at least once per month.

From sustenance to livelihoods, salmon and water are inextricably linked with daily life in Alaska.

Figure 4. A large-scale subdivision along a waterway, designed with stormwater infiltration and habitat functionality in mind.
Source: *SDG, LLC*

Development Guidelines

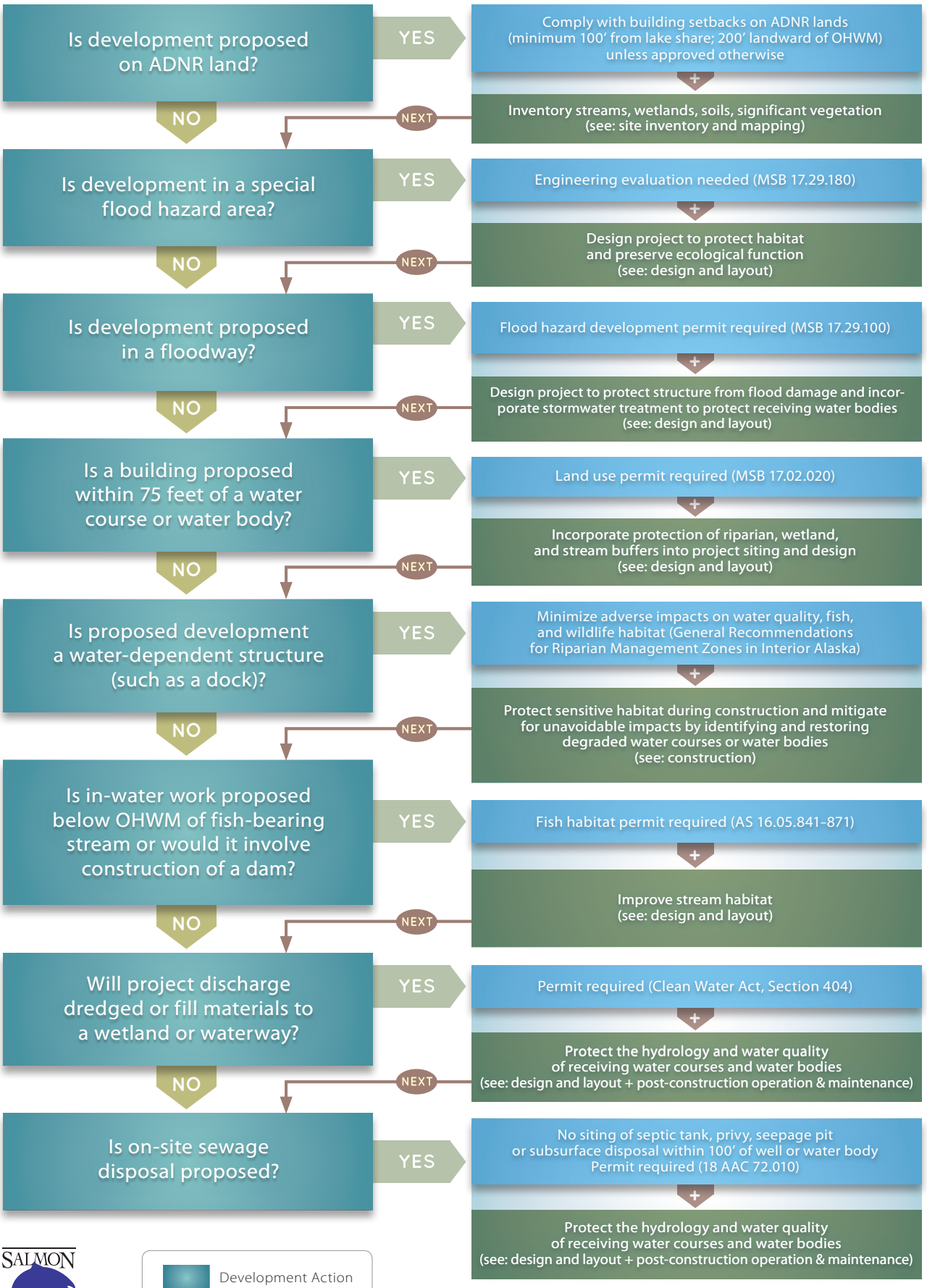
Planning and design ensures development is compatible with and protective of salmon. The development guidelines described in this section are intended to minimize impacts related to water use, erosion and sedimentation, stormwater generation, and loss of vegetation and/or natural habitat. These guidelines could apply to commercial, residential and industrial development throughout the Mat-Su Borough.

To minimize impacts on salmon and salmon habitat, several development practices should be followed:

- conducting a site inventory and mapping;
- creating a fish-friendly site design and layout;
- using environmentally conscious building materials;
- following several construction best management practices; and
- ensuring all components of stormwater facilities are properly functioning using good maintenance practices.

The following process flow chart provides guidance on existing regulatory requirements as well as "above compliance" recommendations. Summarized below, these regulations are applicable to residential and commercial development within and near salmon habitat.

Navigating Regulatory Compliance for Development in the Mat-Su Basin



SALMON SAFE

technical consultant

Herrera Environmental Consulting HERRERA

Site Inventory and Mapping >

PRE DESIGN

Fish-friendly planning and design depend on an understanding of the site and its importance in the landscape relative to streams and wetlands. For the site, at a minimum recognizing the relationships and details of topography, drainage patterns, and existing significant native vegetation are part of preparing a site map and inventory. This site inventory is an important first step to identifying potential hazards, addressing off-site contributions, minimizing stormwater generation and input, and protecting riparian vegetation and natural habitat. Although these tasks are complex, mapping and inventory information below will assist with understanding the process. Design professionals have been specifically trained to perform this work and can assist with completing project work.

Please refer to Appendix F for more information on professionals able to assist with this type of work.

Soils and Slopes

Part of the site inventory should focus on identifying steep or unstable slopes. These areas should be avoided (both as part of the development and as a drainage pathway). Areas where water appears to be infiltrating should be identified, because they present opportunities for infiltrating stormwater.

- Map soil characteristics, including but not limited to soil types, presence of hydric soils, infiltration rates and erosion factors. Unstable and/or highly erodible areas, as well as existing erosion and sedimentation problem areas, should be identified and mapped. Include existing slumps or slope failures, steep slopes and unstable soils as part of the mapping. (U.3.1, U.4.1)

Figure 5. Example of a soil profile.
Source: *Ocean County Soil Conservation District*

Drainage Patterns

The site inventory and mapping should identify existing water flows both on and off site. Map areas of infiltration, discharges to streams and/or wetlands, noting impacts both on and off site. If a ditch from an adjacent property drains onto the site, the mapped location should be considered during design.

- Conduct an off-site drainage analysis, and identify any known or potential off-site drainage or stormwater resources entering the site from an adjacent property based on drainage patterns or topographic maps combined with site visits. (U.1.2)
- Investigate opportunities for stormwater harvest, water reuse and wastewater reclamation during the site inventory and assessment to employ to the greatest extent operationally feasible. (U.2.3)
- If applicable, map and identify areas for storage of chemicals and other environmentally hazardous materials during construction to locate them outside of high-risk areas. (U.4.2)

Figure 6. Allowing infiltration in a residential yard.
Source: *SDG, LLC*

Habitation and Vegetation

Mature trees, intact riparian zones and buffers, wetlands and continuous stretches of vegetation that provide access to wildlife should be identified and protected during development. Opportunities to improve or expand wildlife habitat along streams, wetlands and lakes should be noted.

- Use mapping of habitat patches and corridors and conservation easements within the local region (sites, buildings, roofs, open space) as a tool for maximizing the connectivity between unconnected wildlife habitat and corridors. Connect multiple habitats with larger core habitat zones beyond the immediate project area (U.5.1)
- Inventory existing native and non-native plant species within the area to aid in identifying invasive species for removal, species with high habitat value to maintain or restore, and to set goals for successful establishment (e.g., types, numbers, distribution) of key indicator species.
- Inventory existing native and non-native species of birds, mammals, insects and invertebrates within the area to aid in setting goals for successful establishment (e.g., types, numbers, distribution) and preservation of key indicator species. (U.5.2)
- A riparian inventory should be conducted by a biologist, ecologist, wetland scientist or other qualified professional that characterizes riparian habitat conditions and identifies ideal riparian buffer widths on site. (U.7.1)
- Land with previously undisturbed and functioning habitat such as virgin woodlands should be maintained to the greatest extent possible.

Figure 7. Wetland in Southern Alaska.
Source: *G. Iftner, Herrera Environmental Consultants, Inc.*

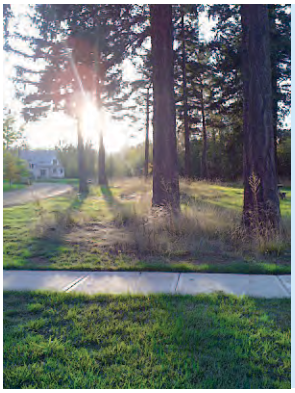


Figure 8. Tree and habitat preservation in the Mat-Su.
Source: *SDG, LLC*

Design and Layout >

DESIGN

Information from the site inventory and mapping should be analyzed and then used to develop a design and layout that (1) protects and expands existing native habitat and vegetation; (2) preserves drainage patterns or addresses identified drainage problems; (3) sites buildings and paved surfaces to minimize site disturbance and avoid impacts to efficient water infiltration; and (4) enhances or improves habitat.

Site Layout

Site inventory and mapping should be used to preserve natural features and minimize development impacts. Buildings, drives and parking configurations should respond to the site analysis. As with other site features, landscape plantings and pedestrian features should respond to the inventory and mapping goals, site issues and environmental concerns.

Figure 9 shows examples of a traditional residential layout and a layout that incorporates low-impact development (LID) concepts. The LID layout uses closely spaced housing, bioretention areas, vegetation retention, bioretention swales, open space and minimized streets to lessen development impacts. Providing adequate covered space for equipment and vehicles can also help ensure that downstream impacts of the development are reduced.

Figure 9. *(below)* Comparison of a traditional development layout with one that incorporates low-impact development techniques.
Source: *Washington Stormwater Center (2017)*

Site Layout

continued...

- The site layout should conserve continuous vegetation and minimize impervious or semi-impervious surfaces, stormwater runoff, and site disturbance while eliminating ineffective or connected impervious areas and/or introducing invasive, non-native plantings.
- Native vegetation and soils should be left undisturbed to the greatest extent feasible. Lots and buildings should be designed with reduced building footprints and located to conserve habitat areas or other open space. Roadway alignment should maximize contiguous open space and limit encroachment on natural resources. (U.1.3)
- Minimize impacts to inventoried and mapped instream areas. Locate buildings and other site improvements outside the floodplain and channel migration zones. At stream crossings, place appropriate utility lines in serviceable locations on bridges rather than burying them in a trench under the stream. (U.6.4)
- Reduce over-water structure impacts by reducing walkway widths, using grated decking materials and elevating walkways.

Figure 10. Pervious trail surface, facilitating stormwater infiltration.
Source: *SDG, LLC*

Figure 11. Significant riparian buffer within a large-scale, new residential development project.
Source: *Pringle Creek Community*

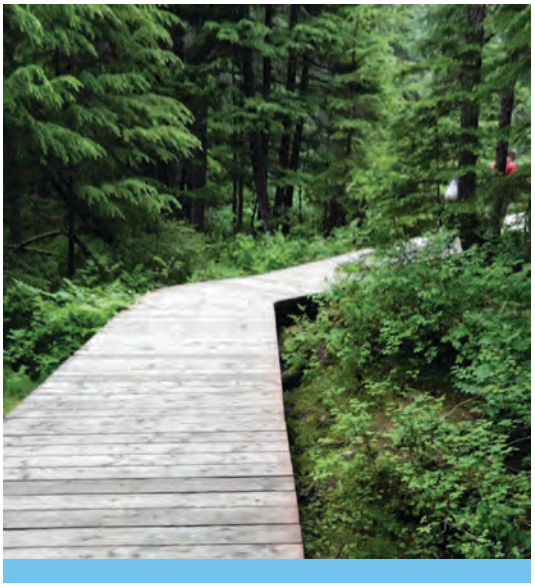


Figure 12. Protection of riparian habitat area through use of an elevated trail.
Source: *SDG, LLC*

Stormwater Management

Site design should employ stormwater infiltration to the greatest extent feasible.

- Conduct stormwater management planning to improve quality and flow control. Fish-friendly stormwater management planning generally follows a hierarchy that prioritizes total on-site water treatment and infiltration strategies as follows (U.1.4):
  - > vegetated facilities
  - > green roof
  - > permeable pavements
  - > treatment using filters
  - > detention using vaults
- Stormwater facilities and infiltration features should be fully integrated with habitat-based site features.
- Design stormwater facilities to meet pre-development hydrology planning goals for water quality and flow control. Stormwater management systems for roadways, parking lots and building runoff should treat storm-water close to the source, use dispersion and infiltration rather than flow concentration and retention/detention, and allow for detention that minimizes storm surges. (U.1.7)
- Design roadways, drives, parking and walkways to deliberately minimize footprints of impervious surfaces and associated stormwater runoff. The design should employ permeable paving materials to the greatest extent feasible. Roadbeds and utility lines should be designed to avoid or limit impact on subsurface water flow. (U.1.5)
- Buildings should be sited and designed to minimize the amount of impervious area and associated stormwater runoff. Rooftop runoff should be treated on site and dispersed or infiltrated rather than concentrated during treatment. (U.1.6)

Figure 13. A home within a new residential development managing rooftop runoff on site.
Source: *Pringle Creek Community*

Figure 14. Bioretention swale in the Mat-Su, used to infiltrate and treat stormwater runoff from the surrounding residential area.
Source: *SDG, LLC*

Stormwater Management

continued...

Examples of best management practices for stormwater management include:

- Infiltrating stormwater runoff to the extent practicable based on-site soils and drainage patterns.
- Treating and managing stormwater to avoid causing flow or water quality problems to receiving waters.
- Where stormwater facilities, such as ponds or swales, discharge directly to streams, the facilities should pose no fish trap hazard during normal or high flow conditions and should be outfitted with screens to prevent fish from entering stormwater management facilities.
- Manage stormwater runoff and sediment during construction or high-water events to avoid transport into surface waters. Filters strips or other LID techniques should be employed.
- Where consistent with the needs of local species, stormwater facilities can incorporate habitat features such as logs, snags and varying pool depths, integrated with the surrounding habitat and vegetation to support connectivity between nearby habitats.

Figure 15. An example of stormwater quantity and quality management in a parking lot.
Source: *Portland State University*

Water Supply

To limit water demand, site design should maintain natural areas and native plants, minimize any open lawn, incorporate appropriate landscaping and encourage use of native vegetation.

- To reduce on-site water withdrawals from salmon-bearing water bodies, groundwater withdrawals should avoid drawing from shallow local aquifers when feasible. Incorporate reduction, reuse, treatment and recycling, and treatment and reclamation into water use. Use potable water sources only if the previous options are infeasible. (U.2.2)
- Temporary irrigation systems can be used for landscape vegetation that typically require water only during establishment periods. Native plants quickly adapt to local conditions, requiring less water and maintenance while enhancing local habitats.
- Employ stormwater and gray water reuse systems within code and regulatory requirements.
- During construction, do not make surface water withdrawals in association with site construction activities (U.2.8). Conduct equipment cleaning off site or sufficiently away from riparian areas and wetlands to avoid accidental runoff, contamination or other impacts on water, habitat and natural resources. (U.2.7)

Figure 16. Urban stormwater collection used with a vegetated edge.
Source: *SDG, LLC*

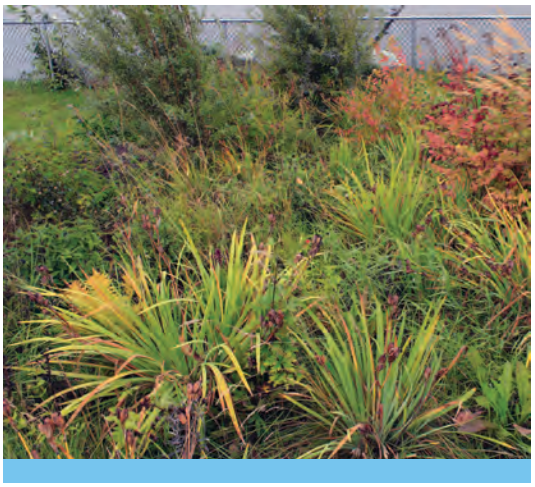


Figure 17. Example of native vegetation in the Mat-Su.
Source: *SDG, LLC*

Landscaping

- The landscape design should include native plants. Invasive species, as defined by local and state agency weed lists, should not be used. For more information on invasive plants in Alaska, see the Terrestrial Weed Identification Field Guide (ADNR, 2014). The use of plants deemed invasive species, as defined by local and state agency weed lists, should be expressly avoided.
- Avoid plants with known susceptibility to disease or those that require nutrient or chemical inputs to survive in existing soils. For existing developments, an analysis to identify and assess opportunities to enhance or replace existing landscape vegetation should be performed. (U.4.6)
- Minimize lawn area to the greatest extent operationally feasible. Use lawn mixes composed of native grass species and drought-tolerant alternative seed mixes.
- Specifications should call for the use of compost and mulch during installation to reduce water demand.

Figure 18. An example of low-input landscaping in a large-scale residential development project.
Source: *Pringle Creek Community*

Figure 19. Plant density reduces the need for hand weeding of native plantings.
Source: *SDG, LLC*

Enhancing Habitat

Ensure that stream bank, channel and instream habitat are functioning on site. Address any deficiencies such as stabilizing failing stream banks using native vegetation, LID techniques and/or addressing out-of-stream impacts. Avoid channel manipulation or implementation of artificial stabilization such as riprap, concrete walls or cribbing.

- Existing site channel, slough, tributary and wetland habitats should remain connected to the stream. Instream habitat, including large wood, should be undisturbed.
- When feasible, habitat improvement projects should use large woody debris and rock salvaged from the site or harvested sustainably from on off-site location to incorporate large wood and rock features. (U.6.8)
- Use bioengineering bank stabilization methods in place of bulkheads or traditional bank armoring.
- Avoid floating docks and/or reduce the amount of in-water structures by decreasing the diameter of piles, increasing the distance between piles and planning for the use of boat lifts.
- Minimize the amount of artificial lighting along any shoreline area. If artificial lighting is required for safety purposes, minimize the amount of light that is directed onto the water or towards the night sky, reduce the intensity of the lighting and restrict the duration of the lighting.
- Avoid development impacts to wetlands and provide a riparian buffer. If wetland impacts cannot be avoided, wetlands should be protected, restored or recreated.
- The site plan should aim to provide or protect and buffer existing off-channel salmonid habitat, improved water quality, additional floodplain storage and/or other habitat benefits associated with proper wetland function. (U.7.5)
- Avoid using wetlands, waterways or critical habitat areas as snow storage during winter months. Runoff from melting snow should be filtered before entering waterways and habitat zones using techniques such as filter strips or biofiltration collection areas.

Figure 20. Beneficial instream large wood.
Source: *SDG, LLC*

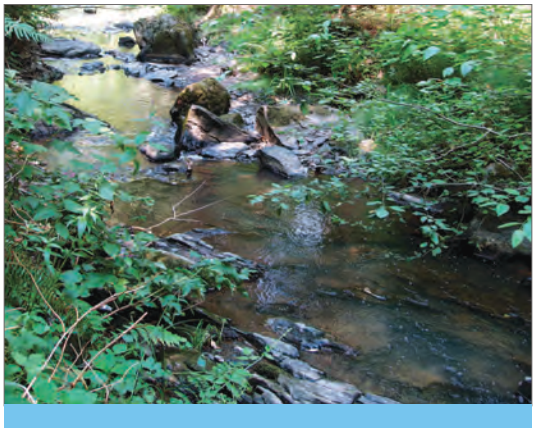


Figure 21. Unimpeded instream habitat.
Source: *SDG, LLC*

Enhancing Habitat

continued...

- Sites can be designed to maximize ecological value by considering strategies for creation and retention of habitat and landscape patches that provide food, forage and refuge for key species.
- In areas undergoing rapid development, connecting patches of habitat can aid in species movement and provide temporary refuge for wildlife. These areas benefit local residents by providing recreational opportunities and access to nature. When applied to multiple sites, an interconnected mosaic of ecological patches can aid in species movement to and from larger, intact habitat patches.

Habitat enhancement strategies can include

1. creation of vegetated pollinator pathways along roadways and through sites to attract bees, butterflies and other species of interest *e.g, bioswales with native fireweed and other native flowers;*
2. promotion of the use of tree species that provide biological diversity and consistent food, forage and refuge for urban species *e.g., mix of spruce, birch, willow, alder and cottonwood;* and
3. extension of right-of-way plantings to maximize street landscape coverage and diversity, and incorporate with stormwater facilities to provide intermittent water, mud and nesting materials, as feasible, given maintenance requirements.

Alaska Fireweed

Enhancing Habitat

continued...

The site plan should detail locations for instream enhancement, barrier removal (if applicable), and other rehabilitation based on the results of the earlier site inventory. The development design should provide adequate fish passage and habitat, and maintain water quality standards while avoiding obstructions at stream crossings. (U.6.9)

Figure 22. Restoring ecological function with root wads.
Source: *SDG,LLC*

- Maximize connectivity between riparian, wetland and upland habitats to the greatest extent operationally feasible. Working with local jurisdictions and adjacent property owners in the region to create synergies with adjacent properties, larger parcels (two or more buildings with similar habitat functions) or neighborhood corridors (expanding and connecting terrestrial and canopy coverage) can be accomplished in rights-of-way and through adjacent sites). (U.5.3)
- Ensure that riparian habitats are unimpeded by development and are contiguously connected to riparian habitat in adjoining parcels. Development near riparian areas should be avoided to the greatest extent feasible. If avoidance of impacts to riparian functions is not feasible, minimize and mitigate the effect by restoring habitat functions where possible. Restore degraded areas by revegetating and removing existing structures or impervious surfaces. (U.7.4)

Building Materials

Hazardous or toxic building and landscape materials should be avoided. Rainwater that comes into contact with them can ultimately enter streams and pose risks to salmon.

Galvanized metal surfaces, gutters and downspouts, as well as pressure-treated wood, can release particulates that harm salmon. Other options for building and landscape materials will not create runoff and leachate that harms wildlife.

- Avoid the use of copper for any exterior materials that will be exposed to rainfall. Even minute amounts of copper can have lethal impacts on salmonids. (U.1.6)
- Expressly avoid the use of any zinc in exterior finishes and uncoated galvanized metal. These release metals that pose risks to aquatic life. (U.1.6)
- To ensure that building materials and facades do not endanger or pose a threat to wildlife, developers should use netting or screening to reduce glare on windows and prevent bird strikes.
- Consider various types of living walls and infrastructure that increase the habitat value of the site. (U.5.5)
- Investigate opportunities for temporary improvements to vacant or under-utilized sites using low-cost plantings that have potential for providing habitat value. (U.5.6)

Figure 23. Example of an urban infiltration basin that reduces runoff and leachate that could harm wildlife.
Source: *SDG, LLC*

Figure 24. As an alternative to asphalt roofing material containing polycyclic aromatic hydrocarbons (PAH's), standing seam metal roofs are fire resistant, long lasting, 100% recyclable and, because they protect water quality, can be used for rainwater harvesting.
Source: *Salmon-Safe*

Construction >

CONSTRUCTION

Reduce ground disturbance, erosion and sediment transport by minimizing excavation, grouping utilities and siting development away from riparian areas, wetlands, and steep slopes such that they are not an obvious source of sediment, chemical pollution or bank instability. (U.3.2)

Construction Practices

Figure 25. Creation of wetlands to reduce storm surges. Source: *SDG, LLC.*

- Where ground disturbance is unavoidable, protect soil from erosion and generation of sediment that could enter surface water bodies. Vegetate bare or exposed soils with native vegetation.
- Strategically place permanent erosion control features such as site grading, flow control and landscaping to prevent sediment from leaving the site. (U.3.3)
- Construction practices should limit soil erosion and eliminate potential sediment inputs into surface waters. Visible or measurable sediment or pollutants should not exit the site or enter the public right-of-way. Measures to prevent erosion and control sedimentation should be installed according to plans, monitored and maintained regularly, and left in place until the site is stabilized. (U.3.4)
- Address long-term erosion and sediment control provisions in the plans by providing and using a construction-phase stormwater management plan on site that includes best management practices to eliminates stormwater runoff and sediment transport into surface waters during construction. (U.3.5)
- To avoid contaminating or polluting nearby water bodies, locate the construction staging area outside of any designated riparian, wetland, habitat or other buffer for storage and maintenance of equipment, vehicles, chemicals or other materials that could reasonably pose a risk to sensitive aquatic habitats. (U.4.7)

Construction Practices

Figure 26. An example of protected fish habitat during construction.
Source: *SDG, LLC*

continued...

- The equipment and vehicle cleaning, fueling, and maintenance plan should be used during construction to limit the import and export of invasive plant seeds, petroleum, or other toxic substances to and from the site. (U.4.8)
- The use of herbicides, pesticides, fertilizers or other chemicals should be avoided during construction, especially within riparian and wetland buffer areas. (U.4.9)
- Ensure fish and wildlife exclusion/protection measures are in place during construction near water bodies. One-eighth inch or smaller screens should be installed on all water intake equipment to avoid entrapment and entrainment of small fish. For work below the ordinary high-water line where fish may be harmed or entrapped during construction, use work area isolation barriers such as cofferdams, silt curtains or other devices at all times. During in-water construction, retain a fisheries biologist or other qualified specialist on-call in the event of accidental fish entrapment. (U.6.10)
- If instream habitat features have been installed, prepare a post-construction inspection and maintenance plan to ensure that instream habitat features are protected during establishment and, ultimately, work as designed. (U.6.11)

Post-Construction Operations & Maintenance

OPERATIONS

Use maintenance strategies that (1) maximize the conservation of beneficial species; (2) reduce the intrusion of invasive species; and (3) provide beneficial habitat elements of food, forage and refuge. This includes activities such as leaving some vegetation over the winter rather than cutting it back and using appropriate composts to amend soils, maintain healthy vegetation and support beneficial soil microorganisms. (U.5.7)

P-C Operations & Maintenance Practices

- Consider designating the project "pesticide free", including educational signage to communicate this to residents and/or visitors. (U.4.3)
- For larger scale residential projects, engage residents in long-term maintenance of landscape and stormwater features through interpretive signage, rain garden workshops and the development of a resident "fish friendly" handbook. Resident handbooks can provide guidance in best management practices and ensure continuous improvement in site management within areas of integrated pest management (IPM), fertilization, water conservation, stormwater facility, maintenance and aquatic habitat restoration.
- Ensure that any fertilizer application is informed by soil testing.
- Ensure that any landscaping and site maintenance conducted by contractors is fully consistent with low-input or pesticide-free operating goals. (U.4.6)
- Consider development of a fish friendly water conservation plan to guide ongoing operations. (U.2.6)

Possible options for further enhancement of water efficiency include:

1. quantifying water use over time to establish a water use baseline and monitor for further reductions as feasible;
2. replacing of any turf and high-maintenance planting beds with drought-tolerant native plantings; and
3. minimizing water demands by planting appropriate species for local conditions.

- Consider maintenance practices that maximize conservation of beneficial species, reduce intrusion of invasive species, and provide beneficial habitat elements for food, forage and refuge. These include such activities as leaving some vegetation on plants over winter rather than cutting them back, reducing pruning and allowing plantings to provide dense refuge.
- Incorporate fish friendly practices in CCR's and other community governance to ensure best management practices are sustained over time.

Figure 27. Controlling invasive species; using maintenance strategies that minimize pesticide use.
Source: *Gardening Step by Step*

Figure 28. Maintaining a restoration project with the help of volunteers.
Source: *SDG, LLC*

References

ADFG. 2017a. **State of Alaska Special Status Species: Fish Stocks of Concern.** Alaska Department of Fish and Game. Accessed August 29, 2017. http://www.adfg.alaska.gov/index.cfm?adfg=specialstatus.akfishstocks

ADFG. 2017b. **Fish Passage Inventory Database (FPID)—Inventory & Assessment: Fish Passage Inventory Map. Alaska Department of Fish and Game**. Accessed August 29, 2017. http://extra.sf.adfg.state.ak.us/FishResourceMonitor/?mode=culv

ADNR. 2014. **Terrestrial Weed Identification Field Guide, 2nd Edition.** Prepared by the State of Alaska, Department of Natural Resources, Division of Agriculture, Plant Materials Center. Anchorage, Alaska. http://plants.alaska.gov/pdf/TerrestrialWeedIdentificationGuide.pdf

Allen, J. 2014. **Housing Needs Assessment 2014.** Matanuska-Susitna Borough Planning & Land Use Department. December.

Berman, M., and J. Armagost. 2013. **Contribution of Land Conservation and Freshwater Resources to Residential Property Values in the Mat-Su Borough.** Institute of Social and Economic Research, University of Alaska Anchorage. February.

Chamard, S., L. Barnes, L. Fox, K. Lyons, D. Reinhard, and D. Witte. **The Matanuska-Susitna Borough Community Survey, 2014, and Trends 2009-2014: A Sourcebook of Community Attitudes.** Publication No. JC 0711.07. Justice Center, University of Alaska Anchorage, in partnership with Matanuska-Susitna Borough.

Earth Advantage. 2015. **The Market Valuation of Energy Efficient and Green Certified Northwest Homes.** Accessed October 16, 2017. https://www.earthadvantage.org/assets/documents/NEEA_Home_Valuation_Report-FINAL.pdf

Great Land Trust. 2012. **Living Next to a Salmon Stream: How to Be a Salmon-Friendly Landowner.** Great Land Trust, Southcentral Alaska, Palmer, Alaska.

Hinman, C. 2012. **Low-Impact Development: Technical Guidance Manual for Puget Sound.** Washington State University and Puget Sound Partnership. December.

Johnson, J., and B. Blossom. 2017. **Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes— Southcentral Region, Effective June 1, 2017.** Alaska Department of Fish and Game, Divisions of Sport Fish and Habitat, March 2017.

Kostelec. 2016. **Matanuska-Susitna Borough MPO Self Assessment: A Blueprint Preparing the Borough for a Metropolitan Planning Organization.** Prepared for Matanuska-Susitna Borough by Kostelec Planning, LLC, Asheville, Carolina. January.

Mat-Su Basin Salmon Habitat Partnership. 2013. **The strategic action plan of the Mat-Su Basin Salmon Habitat Partnership: 2013 Update. The Mat-Su Basin Salmon Partnership.** Accessed August 17, 2017. http://matsusalmon.org/wp-content/uploads/2013/02/MatSu-Salmon-Strategic-Action-Plan-2013_revOct15.pdf

Murphy, M.L., J. Heifetz, S.W. Johnson, K.V. Koski, and J.F. Thedinga. 1986. "Effects of clear-cut logging with and without buffer strips on juvenile salmonids in Alaskan streams". **Canadian Journal of Fisheries and Aquatic Science**, 43:1521-1533.

O'Doherty, G. 2016. **2016 Status Update on Fish Passage Barriers in the Mat-Su Borough.** Presentation for the Alaska Department of Fish and Game. Accessed August 29, 2017. http://matsusalmon.org/wp-content/uploads/2016/11/ODohertyMSB2016.pdf

Owens, P., J. Duffy, L. Finney, B. Grantland, L. Fuller, P. Graham, and D. Selman. 2003. **A property owner's guide to shoreline landscaping in the Matanuska-Susitna Borough.** Prepared by Department of Planning and Land Use, Matanuska-Susitna Borough, Palmer, Alaska.

Summers, D.J. 2016. "Mat-Su mapping study doubles borough stream miles". **Alaska Journal,** February (Issue 3), 2016.

USGBC. 2016. **About Green Homes.** Accessed October 16, 2017.
https://www.usgbc.org/articles/benefits-green-homebuilding

US EPA, Office of Oceans, Wetlands, and Watersheds. 2012. **Costs of Low-Impact Development.** Accessed October 16, 2017.
https://www.epa.gov/sites/production/files/2015-09/documents/bbfs3cost.pdf

Valley Board of Realtors and Mat-Su Borough. 2015. **Matanuska-Susitna Borough Housing Forum.** Prepared by the Valley Board of Realtors and the Matanuska-Susitna Borough Planning & Land Use Department. February 5.

Washington Stormwater Center. 2017. **Statewide Low-Impact Development Training Program.** Accessed September 29, 2017.
http://www.wastormwatercenter.org/lidswtrainingprogram

Appendix A About the Mat-Su Basin

About the Mat-Su Basin

The Mat-Su Borough is so named because it contains the Matanuska River basin and Susitna River basin, which empty into Cook Inlet. The term "basin" applies to all the land that supports the flow and drainage of water into a river as it flows towards the ocean; the term "borough" applies to an administrative unit or municipality, similar to a county. Since the Mat-Su Borough is made up of the river basins for the Matanuska and Susitna rivers, the terms "basin" and "borough" are used synonymously in many supporting documents. For the purposes of this document, we use the term "borough" for development guidelines and regulations and "basin" for describing river or stream habitat or function.

The Mat-Su Borough is in South Central Alaska; the Cook Inlet forms the southern border of the borough. The borough contains part of Denali State Park and Preserve, part of Lake Clark National Park and Preserve, 15 state parks and three large state wildlife refuges covering coastal wetlands (Berman and Armagost, 2013). Resident and anadromous fish, including all five species of Pacific salmon, use habitat in numerous lakes and streams in the borough as well as coastal waters.

The Mat-Su Borough contains one of the few agricultural areas of Alaska. It is also urbanizing rapidly. It lies immediately north of the city of Anchorage, which is the most populous city in Alaska.

The population of the Mat-Su Borough is growing quickly. The 2000 US Census reported 59,322 people and 27,329 housing units. The population grew by about 10 percent between 2010 and 2014—from 88,995 in 2010 (per the US Census) to an estimated 97,882 in 2014 (Kostelec, 2016). By comparison, the population of Alaska as a whole grew by 3 percent over that same time period. The borough's population growth over those four years comprises 33 percent of the state's overall growth. The core area of the borough, which includes the cities of Wasilla and Palmer and the nearby unincorporated areas of Lakes and Knik-Fairview, is where most of the growth occurred. Population estimates show the city of Wasilla grew by 13.0 percent and Palmer grew by 9.7 percent between 2010 and 2014 (Kostelec, 2016). The 2016 US Census population estimate was 104,365, indicating the population has increased more than 75 percent since the 2000 Census.

The 2010 US Census defined the core area of the borough as an "urban cluster" with a population of more than 44,000 people. Given the growth since 2010 in the Mat-Su Borough's urban cluster and continued prospects for growth in the area, it is highly likely that the population will reach 50,000 by the 2020 Census (Kostelec, 2016). At present, Anchorage and Fairbanks are the only urban areas in Alaska with populations of more than 50,000.

Development

The challenges related to growth in the Mat-Su Borough are common to many growing areas of the US. Formerly rural areas that are rapidly transitioning to urban or suburban development patterns are stressed in terms of providing adequate transportation facilities and other public facilities (Kostelec, 2016).

The vast majority of current housing units are single-family homes on large lots in sprawling suburban subdivisions located in a major residential area bounded by Big Lake, Houston, Sutton, Butte, Palmer, and Wasilla, which encompasses the core area. The Mat-Su Borough does not track or issue economic indicators, such as permits, for most development (Allen, 2014). To estimate the number of housing units in the borough, Allen (2014) used tax assessment records from the Mat-Su Borough, which provide location, acreage, appraised and assessed values, and type of building use for each tax lot. Near the end of September 2014, there were 45,553 housing units in the borough (Allen, 2014). Overall, there is a low vacancy rate, and not enough housing to meet demand. Rental properties and affordable units are lacking. (Allen, 2014).

Projected population growth, combined with the general lack of housing, suggests the rate of residential development will increase. The percentage of higher density single-family and multi-family units will likely increase to provide more affordable housing options. Commercial development also will likely increase to provide goods and services to the growing population. Infrastructure, including roads, utilities and other public facilities, will be built to serve the new homes and businesses.

Economy

The unemployment rate in the Mat-Su Borough is 8.30 percent. Job growth is 0.07 percent, and future job growth over the next ten years is predicted to be 31.84 percent (Sperling's, 2017). Employment in the borough is heavily influenced by its proximity to Anchorage. In 2000, over one-third of people who live in the Mat-Su Borough worked in Anchorage (McDowell Group, 2005). Mat-Su residents (35 percent) commuted to Anchorage compared with 28 percent in 1990.

In 2005, about three-quarters of total jobs in the borough were in the private sector and 65 percent of total jobs were in the service sector (McDowell Group, 2005). Trade (retail and wholesale), transportation, utilities and health care account for more than half of the service sector jobs (McDowell Group, 2005). The average per capita income of borough residents is $30,013; the median household income is $72,134 (Sperling's, 2017). Average per capita income in the Mat-Su Borough still lags behind the Anchorage metro area, the state's largest city, and the state.

The Denali, Glenn and Parks Highways all transect the Mat-Su Borough and most communities in the borough are accessible from a highway—unlike in many parts of Alaska. According to the McDowell Group (2005), seasonal bus service provides transportation to Anchorage, Fairbanks and Canada, and the Alaska State Railroad bisects the borough, stopping in Wasilla and Talkeetna as it makes its way from Anchorage to Denali and Fairbanks. At least nine public airports for small aircraft are scattered across the borough. All the transportation links benefit the borough economy—helping residents commute to work, drive to schools, shop, and access recreation areas; providing links to tourist destinations; and facilitating transport of good and services.

About 2.52 percent of the borough population is employed in farming, fishing or forestry; by comparison, 0.73 percent of the US population is employed in those job sectors (Sperling's, 2017). Although the agriculture industry represents a small portion of employment in the borough, the industry leads the state in agricultural production value (McDowell Group, 2005).

According to Berman and Armagost (2013), proximity to open spaces and salmon streams affect property values. Properties near Denali National Park had much higher sale prices than others. Study findings also suggest property values declined about 5 percent per kilometer distance from the nearest salmon stream. "The relatively low, but statistically significant coefficient appears to reflect an enhanced value for a general proximity to areas where salmon fishing may occur, perhaps reflecting the reduced travel cost of seasonal access to the fishery. The effect of proximity to lakes, on the other hand, is large for properties close to the lakeshore, but drops off more rapidly with distance...." however property frontage on the Matanuska River has a strong negative effect on property values (a 41 percent loss) because the river has been eroding its banks in some areas, swallowing several structures of riverfront properties in recent years (Berman and Armagost, 2013). The study estimates that local salmon streams contributed about $25,000 to the market value of a typical residential property sold in 2009 and 2010; lakes contributed about $12,000; and frontage on protected open space increased property values by 17 percent. The estimated total contribution of all natural amenities considered was about $33,000, representing 44 percent of total market value.

In addition to typical questions to borough residents about borough services and facilities, taxation, crime, and other community topics, the Matanuska-Susitna Borough Community Survey of 2014 (Chamard et al., 2014) included questions about salmon, open space and the environment. Overall, survey respondents had positive views about salmon and their contribution to life and the economy in the Mat-Su Borough. Respondents were also likely to agree or strongly agree with statements supportive of environmental protection and management. Respondents were asked to rank seven items based on their importance to their own health. Clean drinking water was ranked as the most important factor contributing to health by 53.7 percent of the respondents, followed by air quality, which was ranked as the most important by 38.9 percent. When asked about their involvement with fishing for subsistence or commercial purposes, more than two-thirds of survey respondents reported having fished for salmon for family food in the past year, while far fewer were involved directly or indirectly in a commercial manner. About one-third of the respondents eat salmon at least once a week or every day, with similar numbers reporting to eat salmon at least once per month.

Stormwater

When communities reach a certain population and density threshold, municipal governments are required to address stormwater under the Alaska Department of Environmental Conservation (ADEC) Alaska Pollutant Discharge Elimination System (APDES) Municipal Separate Stormwater Sewer System (MS4) permit. MS4 permits require local and regional governments to reduce pollutants in stormwater discharges to the maximum extent practicable, and require the use of various best management practices with measurable results. Recent census data may indicate that Wasilla and Palmer are over these thresholds, creating new state requirements. Until new state requirements are triggered, both communities are proactively looking at creative ways to address stormwater concerns and reduce infrastructure lifecycle costs by using best practices and low-impact development techniques (Mat-Su Borough, 2015).

Salmon Presence and Habitat

Eight of Alaska's 14 salmonid Stocks of Concern are in the Mat-Su Borough. "Stocks of Concern" are fish for which there is a yield, management or conservation concern. The Susitna River sockeye and Willow Creek Chinook salmon are of "Yield Concern", the lowest level of concern, defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain specific yields, or harvestable surpluses, above a stock's escapement needs" (ADFG 2017a). The next level of concern, "Management Concern", includes the remaining seven stocks of Chinook salmon. A stock of Management Concern is defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain escapements for a salmon stock within the bounds of a sustainable escapement goal, biological escapement goal, optimal escapement goal, or other specified management objectives for the fishery" (ADFG 2017a). None of the Mat-Su Borough stocks rate "Conservation Concern", the highest level of concern, defined as "a concern arising from a chronic inability, despite the use of specific management measures, to maintain escapements for a stock above a sustained escapement threshold" (ADFG 2017a).

Restoration and Salmon Protection Efforts

Existing strategies to restore and protect salmon in the Mat-Su Borough include educational brochures, a ballot initiative for the protection of wild salmon and fish and wildlife habitat and government funded restoration projects.

The Mat-Su Borough has assembled several best management practice documents, educational pamphlets and voluntary guidelines to help landowners learn fish-friendly practices. Two low-impact development guides were prepared for the MSB by SDG through a USFWS and US Environmental Protection Agency grant to (1) introduce the purpose of LID; (2) assist with determining site-appropriate conditions; and (3) communicate how to construct suitable applications. *Low-Impact Development for Land Owners* (SDG, 2014) and *Low-Impact Development for Contractors* (SDG, 2014) identify and illustrate specific LID techniques adapted to local condition.

A series of panels were prepared for the Mat-Su Borough by USFWS and the US Environmental Protection Agency to educate landowners located along lake shorelines on the basics of lake hydrology and the difference between lake trophic statuses, the importance of riparian buffers, lake-friendly site design, and how to care for lawns in a lake-friendly manner. Living Next to a Salmon Stream (Great Land Trust 2012) is an outreach booklet that aims to educate the public on how to be a salmon-friendly landowner near streams. The voluntary guide, A Property Owner's Guide to Shoreline Landscaping in the Matanuska-Susitna Borough (Owens et al., 2003) provides landowners with the background information and resources on using shoreline vegetation to provide bank stabilization, erosion control, surface runoff water treatment and habitat for wildlife. The aim of the outreach material is to educate the public and establish a connection between people and land so landowners become stewards for the environment.

An initiative prepared for the 2018 ballot in Alaska would add protections for salmon habitat in the face of large projects and provide more opportunities for public comment on new developments. House Bill No. 199 is an act establishing general fish and

wildlife permits and major and minor anadromous fish habitat permits for certain activities; establishing related penalties; and relating to the protection of fish and game and fish and game habitat. The eight-page initiative would create a two-tier permitting system for activity in spawning fish habitat with "minor" or "major" permits, depending on the potential impact. It includes proposed notification of violations and penalties. The bill, if passed, would be consistent with many standards in the Salmon-Safe guidelines for urban development.

In addition to educating the public on how to prevent adverse effects from development and proposing a bill for further salmonid habitat protection, several restoration projects have been completed in the Mat-Su Borough that improve salmonid habitat. The Mat-Su Basin Salmon Habitat Partnership (the Partnership) is comprised of over 60 diverse organizations. Since 2006, they have funded and supported nearly 80 on-the-ground assessment, restoration, protection and education projects that help safe-guard salmon and ensure they remain a part of the culture. In 2016, the Partnership has funded several projects throughout the Mat-Su Borough, including an effort to catalog anadromous and resident fish in previously unmapped streams, characterize watersheds and fish habitat, eradicate invasive species, and improve fish passage.

Salmon Presence and Habitat in the Mat-Su Borough

Chinook, coho, sockeye, pink and chum salmon all return to the streams and lakes of the Matanuska and Susitna river basins each summer to spawn. Of Alaska's 14 salmonid Stocks of Concern—fish that are struggling to maintain their harvest, their population stability, and, in some cases, their survival—eight are in the Mat-Su Borough, including sockeye across the Susitna River basin and Chinook salmon in Alexander Creek, Chuitna River, Goose Creek, Lewis River, Sheep Creek, Theodore River and Willow Creek (ADFG 2017a).

The health of Mat-Su Borough salmon habitat is linked to the level and location of human activity in the basin. In more developed areas of the Mat-Su Borough, there are risks to salmon habitat that are described in this section.

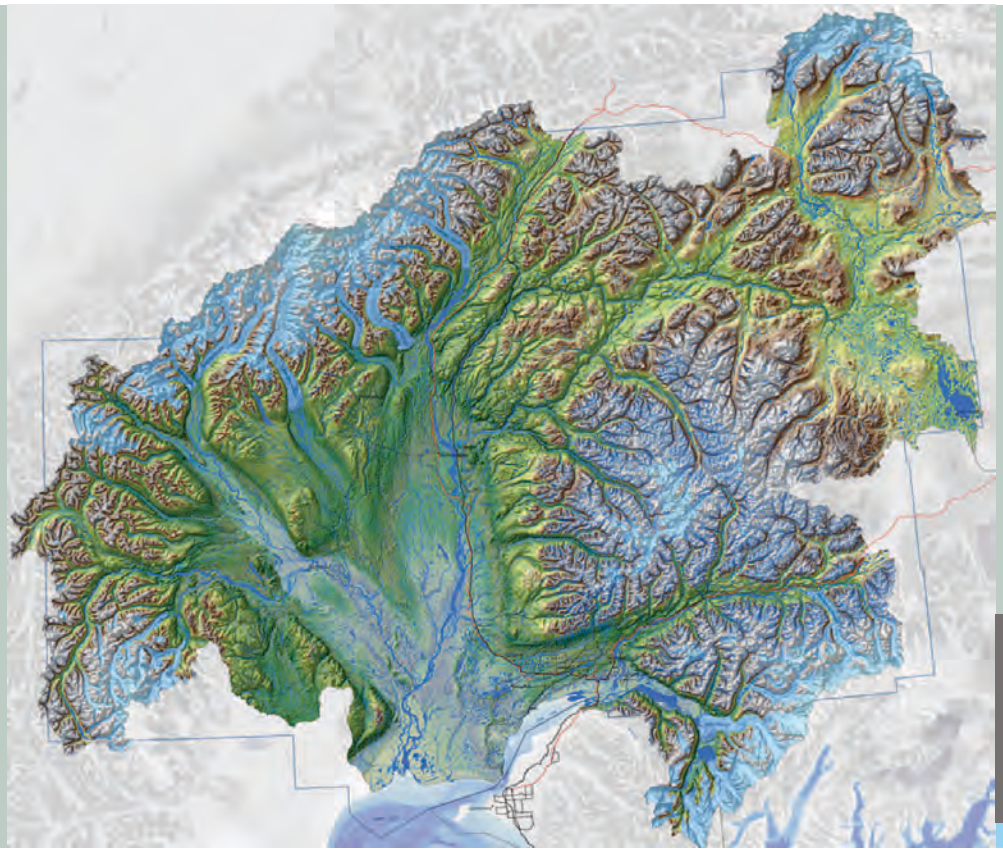


Figure 29.
Braided estuarine channels in the Mat-Su Basin.
Source: *J. DePasquale, The Nature Conservancy in Alaska.*

Streams and Wetlands

The Matanuska and Susitna River basins encompass about 24,500 square miles, and extend from Denali at 20,237 feet to sea level at Cook Inlet. Three mountain ranges—the Alaska, Chugach and Talkeetna—surround the Mat-Su Borough. Thousands of small streams from the mountains combine to form larger creeks and rivers at lower elevations. Many of the rivers, including the Susitna, Little Susitna, Matanuska and Knik, terminate in broad estuarine areas along Cook Inlet. In 2015, a multi-agency collaboration led by The Nature Conservancy

completed a project which mapped all lakes, rivers and streams in the Mat-Su Basin. This project resulted in discovery of over 27,000 lineal miles of previously unmapped streams. There is a total of over 50,000 miles of streams in the Mat-Su, enough to wrap around the equator twice if laid end to end.

Approximately 65 percent of the country's wetlands are in Alaska. Most of the state's freshwater wetlands (approximately 100 million acres) are peatlands, marshes, bogs, fens, tundra and meadows. Another 75 million acres are tidal wetlands and coastal estuaries. Alaska has lost approximately 200,000 acres of wetlands to development activities. Within the Matanuska and Susitna River basins, more than 50,000 miles of streams and 1,340,000 acres of wetlands have been mapped. Much of the borough, however, has not been adequately surveyed, so the total extent of salmon habitat, wetlands and lakes is still being documented (Mat-Su Basin Salmon Habitat Partnership, 2013). For a full list of water bodies with documented use by anadromous fish, see the **Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes** (Johnson and Blossom, 2017).

Wetlands are also important for supporting water quality parameters required by all life stages.

Fish Passage Barriers

Salmon migration, spawning, and rearing are dependent on habitat connectivity. Stream crossing structures affect the movement of fish and other aquatic organisms by altering the stream physical characteristics. Migration barriers can have significant effects on fish production by reducing or eliminating access to important spawning and rearing habitat.

There are hundreds of stream crossings in the Mat-Su Borough. Many of the culverts under highways, neighborhood roads and driveways impede fish passage because they are not of adequate size or properly installed. The Mat-Su Borough partnered with the Alaska Department of Fish and Game (ADFG), the US Fish and Wildlife Service (USFWS) and other organizations to create an ongoing program to identify and replace culverts that block fish passage. As of 2016, the Mat-Su Borough has surveyed and assessed 570 culverts and stream crossings (O'Doherty, 2016).

The level 1 assessment categorized culverts based on fish passage (see Figure 28, next page):

Green
conditions may be adequate to pass juvenile fish

Gray
conditions unlikely to pass juvenile fish, additional analysis required

Red
conditions assumed inadequate to pass juvenile fish, additional analysis required

Black
stream crossings identified but not yet classified

Of the 570 mapped stream crossings and culverts, 32 percent (184 stream crossings) are classified as "green," 18 percent (102 stream crossings) are classified as "gray," 47 percent (269 stream crossings) are classified as "red", and 3 percent (15 stream crossings) are rated black (O'Doherty, 2016). Most of the stream crossings and culverts surveyed and classified are along the George Parks Highway (numbered Interstate A-4 and signed Alaska Route 3), Denali Highway (signed Alaska Route 8) and Glenn Highway (signed Alaska Route 1).

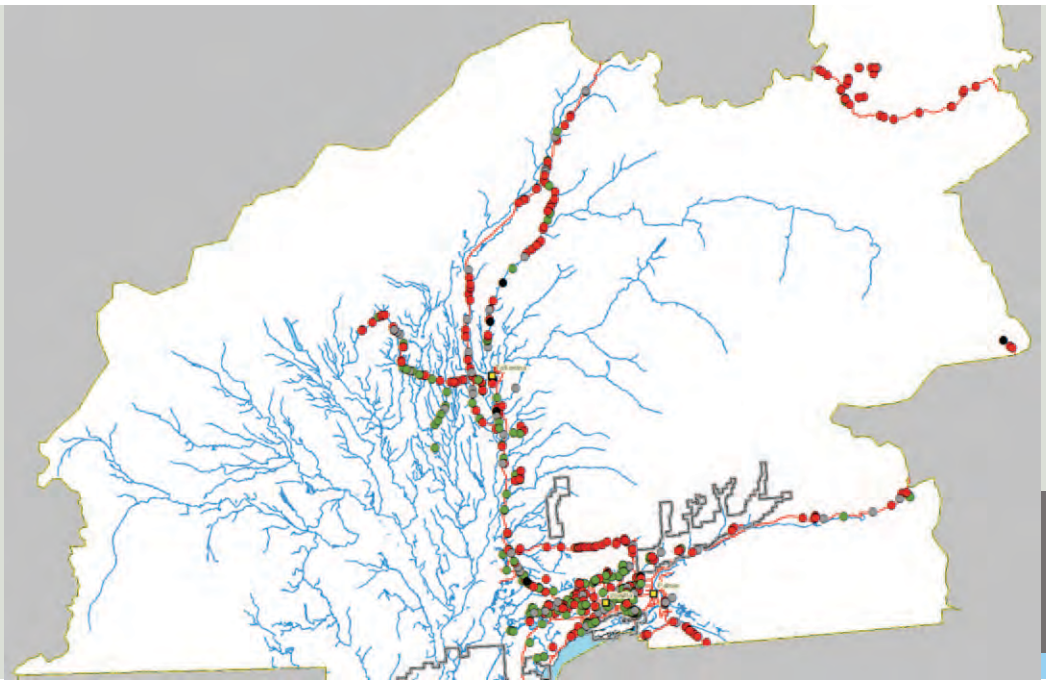


Figure 30.
Map of fish passage barrier status in Mat-Su Borough, Alaska.
Source: *ADFG 2017b*

Riparian Function

Riparian zones have several functions that support spawning, rearing and migrating salmon. They maintain or increase stream organic debris, protect fish habitat, allow increases in primary productivity and can increase the abundance of salmon fry and parr (Murphy et al., 1986). Significant changes in the amount and composition of riparian vegetation can negatively affect water temperature, sediment loads, water velocity, wildlife and fish species diversity, bank stability and nutrient interception.

In 2015, the Palmer Soil and Water Conservation District (PSWCD) conducted riparian impact studies via ground and air for 35 priority Mat-Su water bodies and found 1,821 sites with 123,000 feet (23 miles) of riparian impacts.

Figure 31.
Beneficial woody debris in a Mat-Su stream.
Source: *SDG, LLC*

Appendix B Summary of Regulations

SALMON SAFE

Summary of Regulatory Requirements for Residential and Commercial Development Within and Near Salmon Habitat in the Mat-Su Basin

Proposed Activity / Permit Trigger	Statute / Code	Reference / Link	Requirement	Permitting Agency
NEW BUILDINGS				
Building within 75 feet of waterbody	MSB 17.02 Mandatory Land Use Permit	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/* *https://www.matsugov.us/codecompliance#newconstruction*	**17.02.020 LAND USE PERMIT.** (a) The land owner or authorized agent shall obtain a land use permit from the Matanuska-Susitna Borough Planning Department prior to the commencement of... (6) the construction or placement of any building within 75 feet of any watercourse or waterbody.	Mat-Su Borough
Building near waterbody on ADNR land	**Susitna Matanuska Area Plan, Chapter 2,** Shorelands and Stream Corridors: Management Guideline H and Table 2-1.	**Susitna Matanuska Area Plan (August 2011)** *http://dnr.alaska.gov/mlw/planning/areaplans/sumat/*	Minimum building setbacks: • 150 feet from ordinary high water mark (OHWM) adjacent to anadromous and high value waterbodies (200 feet for tidelands) • 75 feet from OHWM adjacent to all other waterbodies (150 feet for tidelands) Use of a building setback is usually not required if a 'riparian buffer' is being imposed in an authorization. Riparian buffers preclude principal and most accessory structures within the riparian area; only water-dependent uses are authorized in those areas. See Riparian Buffers in Table 2-1 for more detail. If structures are built within the setback, construction should seek to minimize impacts on water quality and habitat. Permits from ADF&G and/or ADEC may also be required.	ADNR
DEVELOPMENT AND USES WITHIN RIPARIAN BUFFER				
Development or use near waterbody on ADNR land	**Susitna Matanuska Area Plan, Chapter 2,** Shorelands and Stream Corridors: Table 2-1.	**Susitna Matanuska Area Plan (August 2011)** *http://dnr.alaska.gov/mlw/planning/areaplans/sumat/*	Riparian Buffers (adjacent to anadromous water bodies and high value fish streams) extend 100 to 150 feet landward of OHWM (lakes and streams), and landward and seaward of mean high water line (tidelands) Only water-dependent uses or structures that do not require extensive de-vegetation and/or land clearing are allowed within the first 60 feet measured from OHWM. "Extensive" means not more than 20% of affected area within the project site. Water-related uses or structures that do not de-vegetate more than 40% of the affected area are allowed in areas more than 60 feet from OHWM. Other uses not allowed within riparian buffer.	ADNR
CONSTRUCTION				
Construction activities that disturb more than 1 acre, or disturb less than 1 acre and are part of a larger common plan of development or sale that totals at least 1 acre	**Clean Water Act** and **18 AAC 72, Wastewater Disposal**	**Mat-Su Borough Stormwater Management Plan** *(adopted November 5, 2013)* *https://www.matsugov.us/plans/stormwater-management-plan*	Must be authorized under the **Alaska Construction General Permit**. Any person wishing to obtain coverage under the general permit must first create a **Stormwater Pollution Prevention Plan** for the site and submit a **Notice of Intent**. Responsibilities are listed here: *http://dec.alaska.gov/WATER/wnpspc/stormwater/sw_construction.htm*	ADEC with US EPA

Summary of Regulatory Requirements for Residential and Commercial Development Within and Near Salmon Habitat in the Mat-Su Basin

Proposed Activity / Permit Trigger	Statute / Code	Reference / Link	Requirement	Permitting Agency
DEVELOPMENT AND USES IN URBAN AREAS				
Residential and commercial development and uses in urbanized areas	Clean Water Act	Mat-Su Borough Stormwater Management Plan *(adopted November 5, 2013)* *https://www.matsugov.us/plans/stormwater-management-plan*	The **Stormwater Management Plan** provides guidance for managing stormwater and includes measures that may be required when urbanized areas of the Mat-Su Borough are subject to **APDES MS4 (Municipal Separate Storm Sewer System)** permit requirements, which is imminent. Particularly relevant to residential and commercial uses and development are measures to control stormwater runoff and prevent water pollution.	ADEC with US EPA
PESTICIDE APPLICATION				
Application of pesticides that will result in discharge to a water of the US	Section 301(a), Clean Water Act and 18 AAC 83.015	ADEC, Division of Water, APDES 2017 Pesticide General Permit *http://dec.alaska.gov/WATER/wnpspc/stormwater/PesticideGP.html*	**APDES Pesticide General Permit** covers point source discharges of pollutants associated with the application of biological pesticides or chemical pesticides that leave a residue from the following use patterns: (1) mosquito and other flying insect pest control; (2) aquatic weed and algae control; (3) aquatic nuisance animal control; and(4) forest canopy pest control. To determine if you need an **APDES permit**, use the **Pesticide Decision Tool** here: *http://dec.alaska.gov/WATER/wnpspc/stormwater/PesticideGP-Tool.html#stepOneSection*	ADEC with US EPA
SEWAGE, WASTEWATER AND/OR SOLID WASTE DISPOSAL/DISCHARGE				
Sewage and wastewater disposal/discharge to water of the state	MSB Chapter 8.25 Water Pollution Control	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/*	**Permit from ADEC** **8.25.030** SEWAGE DISPOSAL. (a) A person may not discharge or dispose, from facilities under the person's control, sewage or other wastes so sewage or other wastes shall gain access to any surface or subsurface waters of the state within the borough unless the sewage or wastes are first treated through a collective or individual sewage disposal system adequate to prevent water pollution. (b) Cesspools shall not be permitted. (c) Septic tanks shall have minimum tank capacities as follows: (1) one to four bedrooms: 1,000 gallons; (2) for each additional bedroom: 250 gallons shall be added to the minimum tank capacity. (d) A person shall not conduct a commercial or industrial operation which results in the disposal of solid or liquid waste material into the waters of the state within the borough without procuring a permit from the state department of environmental conservation.	Mat-Su Borough ADEC
Subsurface sewer system	MSB Chapter 8.25 Water Pollution Control	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/*	**8.25.040** USE AND LOCATION OF FACILITIES. • An abandoned well or deep well may not be used for the disposal of sewage or used as a receptacle for household wastes. • A septic tank, privy, seepage pit or subsurface disposal field may not be located within 100 feet of a well or within 100 feet of a lakeshore, stream, or any other body of water.	Mat-Su Borough

SALMON SAFE

Summary of Regulatory Requirements for Residential and Commercial Development Within and Near Salmon Habitat in the Mat-Su Basin

Proposed Activity / Permit Trigger	Statute / Code	Reference / Link	Requirement	Permitting Agency
Discharge to waterbody	MSB Chapter 8.25 Water Pollution Control	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/*	**8.25.050** POLLUTION PROHIBITED. A person may not pollute or add to the pollution of any lake, stream or other body of water.	Mat-Su Borough
Wastewater discharge	18 AAC 72 Wastewater Disposal	Alaska Administrative Code **18 AAC 72:** Wastewater Disposal *(as amended through October 22, 2016)* *http://dec.alaska.gov/commish/regulations/pdfs/18-AAC-72.pdf*	**18 AAC 72.020** Separation distances. (b) The minimum separation distance between the mean annual high water level of a lake, river, stream, spring, or slough, or the mean higher high water level of coastal waters, and a lift station, holding tank, septic tank, soil absorption system, seepage pit, pit privy, or other wastewater collection, treatment or disposal system is 100 feet, measured horizontally.	ADEC
Wastewater discharge to water of the state	18 AAC 72 Wastewater Disposal	Alaska Administrative Code **18 AAC 72:** Wastewater Disposal *(as amended through October 22, 2016)* *http://dec.alaska.gov/commish/regulations/pdfs/18-AAC-72.pdf*	**18 AAC 72.010** Permit and plan approval requirements. (a) A person who disposes of domestic wastewater into or onto land, surface water, or groundwater must have a permit from the department, if the department requires a permit under **18 AAC 72.215** or under **18 AAC 83**, and a plan approved by the department if the department requires a person to obtain approval under **18 AAC 72.200**. The permit or approval must be obtained before beginning construction of a domestic wastewater treatment and disposal system.	ADEC
Domestic wastewater discharge from seasonal or temporary camp	ADEC Water Quality Standards, Assessment and Restoration	Temporary Camp Practices Consolidated Application and Worksheet *(Rev. 05/2017)* *http://dec.alaska.gov/eh/fss/forms/food/temp_camp_application_worksheet_2017.pdf*	**Wastewater General Permit** is required for some temporary and seasonal camps. To determine whether permit is required for a temporary camp, complete ADEC's **2007 Temporary Camp Practices Consolidated Application and Worksheet**, which also includes requirements and guidance for disposal of human wastes; graywater handling, treatment and disposal; and more. Permits, authorizations, and engineered plan approvals are required for wastewater disposal, food service, and drinking water at "large temporary camps" (25 persons or more).	ADEC
DEVELOPMENT IN FLOOD AREAS				
Development within Special Flood Hazard Area	MSB Chapter 17.29 Flood Damage Prevention	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/*	**Flood Hazard Development Permit** **17.29.100** DEVELOPMENT PERMIT REQUIRED. A development permit shall be obtained before construction or development begins within any area of special flood hazard established in **MSB 17.29.060**. The permit shall be for all structures, including manufactured homes, as set forth in the definitions, and for all development including fill and other activities, also as set forth in the definitions. Development within special flood hazard areas must meet applicable standards of **17.29.160 GENERAL STANDARDS FOR FLOOD HAZARD REDUCTION** and **17.29.170 SPECIFIC STANDARDS**.	Mat-Su Borough

SALMON SAFE

Summary of Regulatory Requirements for Residential and Commercial Development Within and Near Salmon Habitat in the Mat-Su Basin

Proposed Activity / Permit Trigger	Statute / Code	Reference / Link	Requirement	Permitting Agency
Development within Floodway	MSB Chapter 17.29 Flood Damage Prevention	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/*	"No rise" certification by engineer: **17.29.180** FLOODWAYS. (A) Located within areas of special flood hazard established under **MSB 17.29.160** are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles and erosion potential, the following provisions apply: (1) Encroachments, including fill, new construction, substantial improvements, and other development, are prohibited unless certification by a registered professional engineer is provided demonstrating through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge. (2) If the requirement of subsection (A)(1) of this section is satisfied, all new construction and substantial improvements must comply with all applicable flood hazard reduction provisions of **MSB 17.29.160** through **17.29.170**.	Mat-Su Borough
Development in shallow flood areas (AO zone)	MSB Chapter 17.29 Flood Damage Prevention	Matanuska-Susitna Borough Code *http://www.codepublishing.com/AK/MatanuskaSusitnaBorough/*	Development proposed in shallow flood areas (AO zones) must comply with the standards in **MSB 17.29 STANDARDS FOR SHALLOW FLOOD AREAS (AO ZONES)**.	Mat-Su Borough
WORK OR DEVELOPMENT IN WETLAND OR WATERWAY				
Discharge of dredged or fill materials into water of the US; includes, for example, building stream crossings, culverts, docks, etc.; diverting a stream; altering a lake shore; filling a wetland; stabilizing banks; most work in wetlands or below OHWM of waterway	Clean Water Act, Section 404	USACE, Alaska District, Regulatory Division Homepage *http://www.poa.usace.army.mil/Missions/Regulatory.aspx*	**Clean Water Act Section 404 Permit** Compensatory mitigation may be required. Permit (individual or general) is required from USACE for discharge of dredged or fill material into water of US. To obtain permit, must demonstrate that applicant has: (1) taken steps to avoid impacts, (2) minimized potential wetland impacts, (3) provided compensation for unavoidable wetland impacts. Applicant must provide name of waterbody to be affected; project description and purpose; reasons for discharge of fill or dredged material; discharge amount, type, and surface area; description of avoidance, minimization, and compensation measures; info on permit applications for other agencies. As part of review process for **Section 404** permit, USFWS and NMFS may evaluate impacts on fish and wildlife.	USACE with US EPA
Activity permitted through Section 404 Nationwide Permit from USACE	**Clean Water Act, Section 404:** General Conditions to Nationwide Permits and Alaska District Regional Conditions to the 2017 Nationwide Permits	USACE, Alaska District, Regulatory Division *http://www.poa.usace.army.mil/Missions/Regulatory/Permits/Nationwide-Permits/*	If using a **Section 404 Nationwide Permit**, comply with all relevant general and regional conditions, for example: **General Condition 2**. *Aquatic Life Movements* "No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water." *> continues next page*	USACE with US EPA

SALMON SAFE

Summary of Regulatory Requirements for Residential and Commercial Development Within and Near Salmon Habitat in the Mat-Su Basin

Proposed Activity / Permit Trigger	Statute / Code	Reference / Link	Requirement	Permitting Agency
			... continued from page 4 **General Condition 3.** *Spawning Areas* "Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized." Regional Condition C—*Activities Involving Trenching* "Trenches may not be constructed or backfilled in such a manner as to drain waters of the U.S. (e.g., backfilling with extensive gravel layers, creating a French drain effect)." Regional Condition D—*Site Restoration for Projects with Ground Disturbing Activities* Requires disturbed areas to be stabilized immediately after construction; revegetation must begin in the same growing season as the disturbance unless USACE approves additional time; soils must be sorted, stockpiled separately, and topsoil replaced for seeding and planting with native species. Regional Condition F—*Maintenance of Hydrology Patterns* "Natural drainage patterns shall be maintained using appropriate ditching, culverts, storm drain systems and other measures to prevent ponding or drying." Regional Condition G—*Relocation of Stream Beds* "Relocated stream channels shall approximate the length, meander pattern, gradient, channel cross-section, substrate and flow velocity of the original stream channel. Relocated stream channels shall be designed and constructed to avoid excessive loss of flow through the bed or dewatering of the stream channel. The relocation of stream channels shall include establishment of an associated floodplain. The floodplain should be of similar dimension and form as the original."	
Activity requiring a federal license or permit to conduct any activity including, but not limited to, the construction or operation of facilities, which may result in any discharge into a water of the US	Clean Water Act, Section 401 18 AAC 15.180, ADEC Administrative Procedures 18 AAC 70, Water Quality Standards	Alaska Water Quality Certification Process *http://en.openei.org/wiki/RAPID/Roadmap/14-AK-d*	**Section 401** provides states with the legal authority to review an application or project that requires a federal license or permit (such as a **Section 404** permit) that might result in a discharge into a water of the US. The applicant must apply for and obtain a **Certificate of Reasonable Assurance** from ADEC to conduct a regulated activity; the federal permit application serves as the **Section 401** certification application. ADEC reviews the project description; coordinates with other state and federal agencies and local governments; reviews any public comments; and either approves, approves with conditions, waives, or denies the project based on compliance with the **Clean Water Act**, state water quality standards and other applicable state laws.	ADEC, Division of Water, with US EPA

SALMON SAFE

Summary of Regulatory Requirements for Residential and Commercial Development Within and Near Salmon Habitat in the Mat-Su Basin

Proposed Activity / Permit Trigger	Statute / Code	Reference / Link	Requirement	Permitting Agency
Any activity or project conducted below OHWM of anadromous stream	**Alaska Fishway (or Fish Passage) Act** AS 16.05.841 **Anadromous Fish Act** AS 16.05.871-.901	**Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes—Southcentral Region** *(updated annually and adopted into regulation 5 AAC 95.011)* *https://www.adfg.alaska.gov/sf/SARR/AWC/* **Fish Habitat Permit Application** *http://www.adfg.alaska.gov/index.cfm?adfg=uselicense.main*	Any activity or project that is conducted below the OHWM of an anadromous stream (listed in the *Catalog of Waters*) requires a **Fish Habitat Permit**. **Fish Habitat Permit** is required before any action is taken "to construct a hydraulic project, or use, divert, obstruct, pollute, or change the natural flow or bed of a specified river, lake, or stream... " or " ...to use wheeled, tracked or excavating equipment or log-dragging equipment in the bed of a specified river, lake or stream... " [quoted portions from **AS 16.05.871(b)**]. This requirement includes, but is not limited to, construction, maintenance, repairs, or placement of structures, docks, bulkheads, road crossings (culverts, bridges, fords), stream diversions and bank stabilization projects; gravel removal; dumping any material into (or onto ice over) a water body; placer mining; water withdrawals or appropriations; the use of vehicles or equipment in the water body; and the use of explosives in or near the water body.	ADF&G
Placing a dam or other obstruction across any fish-bearing stream	**Alaska Fishway (or Fish Passage) Act** AS 16.05.841-.861	**Fish Habitat Permit Application** *http://www.adfg.alaska.gov/index.cfm?adfg=uselicense.main*	**Fish Habitat Permit** is required before a dam or other obstruction is built across a stream used by fish. Procedures for obtaining a **Fish Habitat Permit** under, **AS 16.05.841** are the same as those outlined above for **AS 16.05.871**. The ADF&G recommends contacting the appropriate Division of Habitat office if there is any question about whether the project requires a **Fish Habitat Permit.** **AS 16.05.841** requires construction and maintenance of a fishway and a device for efficient passage of downstream migrants for any dam or other obstruction built across a stream frequented by salmon or other fish, the submission of plans and specifications for review and approval by ADF&G and that the structure be kept open, unobstructed and supplied with enough water to maintain the free and efficient passage of fish through it. If a fishway is determined by the commissioner to be impractical, **AS 16.05.851** allows for the owner/applicant to compensate for the loss resulting from the dam or obstruction by paying a lump sum acceptable to the commissioner to the fish and game fund; convey a site and construct a new hatchery and all related facilities; or fund the expansion, maintenance and operation of an existing hatchery.	ADF&G

AAC = Alaska Administrative Code
ADEC = Alaska Department of Environmental Conservation
ADF&G = Alaska Department of Fish and Game
ADNR = Alaska Department of Natural Resources
APDES = Alaska Pollutant Discharge Elimination System
AS = Alaska Statute
Mat-Su = Matanuska-Susitna
MHHW = mean higher high water
MSB = Matanuska-Susitna Borough Code
OHWM = ordinary high water mark
USACE = US Army Corps of Engineers
US EPA = US Environmental Protection Agenc

Prepared July 2017

Appendix C Gap Analysis and "Above Compliance" Standards

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.1. Stormwater Management							
U.1.1. Existing site improvements related to stormwater management have been inventoried.	X						While stormwater management requirements in the MSB[1] basin and statewide are limited, there likely will be requirements with the upcoming MS4 permit. The site features and characteristics identified under U.1.1 (topography, soils with good infiltration, existing infrastructure and impervious surface coverage) should be considered to improve site planning. This standard is consistent with **4.3(B)(3)** of **MSB Stormwater Management Plan**.
U.1.2. An offsite drainage analysis has been conducted.	X						A drainage plan is required as part of a multi-family development application, but it would be applicable as "above compliance" guidelines for other development. See **MSB Code 17.72.050(B)(2)(d)**, defined in **17.125.010**. The **MSB Stormwater Management Plan** discusses challenges of historic drainage practices and notes the fact that drainage does not necessarily respect property boundaries. An off-site drainage analysis offers is considered "above compliance" standards.
U.1.3. Site conditions to conserve existing vegetation, minimize impervious surface area, and minimize stormwater runoff.	X				X		This standard promotes preservation of native vegetation and features with ecological function, and maintains riparian buffers between development and streams or wetlands to improve hydrology and water quality. These are good design practices that should be considered as "above compliance" standards. They are consistent with the **MSB Stormwater Management Plan** and other local guidelines and requirements. See **MSB Code 17.36.220** and **MSB Ordinance 05-023**.
U.1.4. Stormwater management planning and design—flow control and water quality.	X		X				Stormwater treatment that focuses on improving water quality is very important and is included as an "above compliance" standard, especially for sites that drain to salmon-bearing streams. There are currently no defined flow control design standards, so emphasizing maximizing infiltration and minimizing impervious surfaces should be the priority for flow control. See **MSB Code 17.02**, **17.29**, and **17.55**; and Tables 2 and 3 in **MSB Stormwater Management Plan**.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.1.5. Minimize impervious areas associated with parking and roadways.							This standard would be applicable as "above compliance" guidelines.
U.1.6. Building design minimizes impervious surface area.	X						This standard would be applicable as "above compliance" guidelines. See **MSB Code 17.73.130(A)(1)** and **MSB Ordinance 05-023**.
U.1.7. Stormwater facility design—water quality and flow control.	X						This standard would be applicable as "above compliance" guidelines. Special considerations should be taken for cold climate stormwater controls. See Table 1 in **MSB Stormwater Management Plan**.
U.1.8. Stormwater facilities and infiltration features that are fully integrated with habitat-based site features.							This standard would be applicable as "above compliance" guidelines.
U.1.9. Construction practices that reduce or avoid short- and long-term negative stormwater impacts.		X					Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.1.10. Adopt long-term stormwater management plan.	X						Consistent with **MSB Stormwater Management Plan**.
U.2. Water Use Management							
U.2.1. Site water infrastructure inventory related to water use and disposal.	X						ADNR[2] has a voluntary Well Log Tracking System (WELTS) online service. Consistent with **MSB Stormwater Management Plan**, "**Water Quality and Drinking Water**".
U.2.2. Avoid surface water withdrawals.					X		This standard would be applicable as "above compliance" guidelines. See **Alaska Code 16.05.841-871**.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.2.3. Stormwater harvest, water reuse and wastewater reclamation.							This standard would be applicable as "above compliance" guidelines.
U.2.4. Connect sanitary systems to public infrastructure.		X	X				Consistent with **MSB Code 8.25.030** and **8.25.040**, and **MSB Ordinance 05-023**.
U.2.5. Select appropriate landscape vegetation to limit water demand.							This standard supports landscaping practices that will reduce degradation of water bodies and would be applicable as "above compliance" guidelines.
U.2.6. Water conservation practices used during site maintenance.							This standard would be applicable as "above compliance" guidelines.
U.2.7. Clean equipment off site, away from riparian and wetland resources and buffers.					X	X	Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.2.8. No surface water withdrawals are made in association with site construction activities.					X		This standard would be applicable as "above compliance" guidelines. See **Alaska Code 16.05.841-871**.
U.2.9. Develop a water conservation plan.							This standard would be applicable as "above compliance" guidelines. See **Policy CQ2-2** of **MSB Comprehensive Plan (2005 Update)**.
U.3. Erosion Prevention & Sediment Control							
U.3.1. Soil characteristics have been mapped.							Some soils of MSB are mapped on the USDA NRCS[3] **Alaska Soil Survey**. This standard would be applicable as "above compliance" guidelines.
U.3.2. Site development designed to minimize ground disturbance, erosion and sediment transport.	X						Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines. See **MSB Code 17.29.030**.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.3.3. Soil is protected from erosion and generation of sediment that could enter surface water bodies.							There are no regulations to protect soils from erosion except in siting development within special flood hazard areas. Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.3.4. Construction practices limit soil erosion and eliminate potential sediment inputs into surface waters.							Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.3.5. Provide standards that protect soil from erosion and prevent transport of sediment into streams or offsite stormwater.							Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.4. Pesticide Reduction & Water Quality Protection in Landscaping							
U.4.1. Identify and map high risk areas.							This standard would be applicable as "above compliance" guidelines. See U.1.1. (above) for mapped surface connections to streams, wetlands and other sensitive water bodies; see U.3.1. (above) for information on steep slopes or unstable soils.
U.4.2. Areas identified for chemical storage during construction staging are mapped and located outside of high risk areas.							This standard would be applicable as "above compliance" guidelines.
U.4.3. Landscape plans that require minimal chemical and nutrient use.					**X**		Consistent with **4.3(A)(1)** of **MSB Stormwater Management Plan** and MSB educational panels.
U.4.4. Locate designated dog run or livestock areas outside of required wetland and riparian buffers.	**X**						Consistent with **4.3(A)(1)** of **MSB Stormwater Management Plan** and MSB educational panels.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.4.5. Connect sanitary systems to public infrastructure.		X	X				Consistent with **MSB Code 8.25.030** and **8.25.040**; and **MSB Ordinance 05-023**.
U.4.6. Landscape vegetation includes either native plants or hardy non-native plants requiring minimal chemical application.							This standard would be applicable as "above compliance" guidelines.
U.4.7. Locate staging area outside of designated riparian, wetland, or other buffer.							Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.4.8. Follow equipment and vehicle cleaning, fueling, and maintenance plan.							This standard would be applicable as "above compliance" guidelines.
U.4.9. Avoid use of herbicides, pesticides, or other chemicals, especially within riparian and wetland buffer areas. Refer to Salmon-Safe's **High Hazard Pesticides List** for pesticides known to cause problems for salmonids and other aquatic life.		X			X		Consistent with the intent of **MSB Code 8.25.050**. This standard would be applicable as "above compliance" guidelines.
U.4.10. Prepare and implement an integrated pest management plan and nutrient management plan.					X		Consistent with **4.3(A)(1)** and **4.3 (C)** of **MSB Stormwater Management Plan** and MSB educational panels.
U.5. Enhancement of Urban Ecological Function							
U.5.1. Provide landscape scale mapping of habitat patches and corridors within the local region to maximize habitat connectivity.							Consistent with the intent of **4.3(C)** of **MSB Stormwater Management Plan** and would be applicable as "above compliance" guidelines.
U.5.2. Survey bird, mammal, insect, and invertebrate composition within the region to identify and set goals for key indicator species.							This standard would be applicable as "above compliance" guidelines.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.5.3. Work with local property owners to create synergies with adjacent properties to provide larger parcels or corridors.							This standard would be applicable as "above compliance" guidelines.
U.5.4. Site strategies to create and retain habitat and landscape patches that provide food, forage and refuge for key indicator species.	X						Consistent with **MSB Code 17.36.220** and **Policy LU4-1** and **LU4-2** of **MSB Comprehensive Plan (2005 Update)**.
U.5.5. Ensure building materials and facades do not endanger or pose a threat to wildlife.							This standard would be applicable as "above compliance" guidelines.
U.5.6. Improve existing environmental condition of sites prior to and during construction, restoration and refitting.	X						Consistent with the intent of **MSB Code 17.36.220** and would be applicable as "above compliance" guidelines.
U.5.7. Use maintenance strategies that maximize conservation of beneficial species, reduce invasive species, and provide beneficial habitat.							This standard would be applicable as "above compliance" guidelines.
U.6. Instream Habitat Protection & Restoration							
U.6.1. Complete a physical instream inventory that characterizes habitat quality conditions for salmonids and other sensitive species.					X		Consistent with **Policy PO2-3** and **Policy CQ1-1** of **MSB Comprehensive Plan (2005 Update)**. See **Alaska Code 16.05.841-871**.
U.6.2. Complete a biological instream inventory that characterizes riparian and aquatic habitat conditions and characterize fish access.					X		Consistent with **Policy PO2-3** of **MSB Comprehensive Plan (2005 Update)**. See **Alaska Code 16.05.841-871**.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.6.3. Site plan that details locations for instream enhancement, barrier removal, or rehabilitation on results of site inventory.				X	X		Consistent with **Alaska Code 16.05.841-871** and ***proposed bill Alaska Code 16.05.867.***
U.6.4. Site plan avoids impacts to instream areas identified in the site inventory.					X		This standard would be applicable as "above compliance" guidelines. See **Alaska Code 16.05.841-871**; **Policy CQ1-2**, **Policy CQ2-2** and **Policy CQ2-3** of **MSB Comprehensive Plan (2005 Update)**; and ***proposed bill Alaska Code 16.05.871.***
U.6.5. When avoidance is not possible, the site plan minimizes impacts on instream habitat.				X	*X*		Consistent with **Policy CQ1-4** of **MSB Comprehensive Plan (2005 Update)**. See ***proposed bill Alaska Code 16.05.887.***
U.6.6. Mitigate to offset unavoidable physical and biological stream impacts.				X	*X*		Consistent with **Policy CQ2-4** of **MSB Comprehensive Plan (2005 Update)**. See **Alaska Code 16.05.841** and ***proposed bill Alaska Code 16.05.875-887.***
U.6.7. Address and resolve key deficiencies on stream bank conditions identified in the physical instream habitat inventory.							Consistent with the intent of **Policy CQ2-1** of **MSB Comprehensive Plan (2005 Update)**. This standard would be applicable as "above compliance" guidelines.
U.6.8. Address and resolve key deficiencies on channel and instream habitat identified in the physical instream habitat inventory.							Consistent with the intent of **Policy CQ2-1** of **MSB Comprehensive Plan (2005 Update)**. This standard would be applicable as "above compliance" guidelines.
U.6.9. Remove barriers and man-made features identified in the physical instream habitat inventory.				X			The **MSB Salmon Passage Improvement Plan** addresses culverts only. See **Alaska Code 16.05.841**. This standard would be applicable as "above compliance" guidelines.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.6.10. Fish and wildlife exclusion/protection measures are in place during construction near water bodies.					X		This standard would be protected under the proposed bill to protect wild salmon, fish and wildlife habitat. See **Alaska Code 16.05.841-871** and ***proposed bill Alaska Code 16.05.871.*** This standard would be applicable as "above compliance" guidelines.
U.6.11. Develop a post-construction inspection and maintenance plan to ensure instream habitat features are working as designed.							This standard would be applicable as "above compliance" guidelines.
U.7. Riparian, Wetland and Locally Significant Vegetation Protection & Restoration							
U.7.1. A riparian inventory is conducted by a biologist, ecologist, wetland scientist or other qualified professional that characterizes riparian habitat conditions on site.							Besides setbacks from buildings and septic tanks, the MSB Code has no regulations protecting riparian zones. See **4.3(C)** of **MSB Stormwater Management Plan**. This standard would be applicable as "above compliance" guidelines.
U.7.2. A wetland inventory is conducted by a wetland scientist or other qualified professional that adequately characterizes wetland habitat conditions.						X	Jurisdictional wetlands are protected by USACE[4] Section 404 permits: Individual and General. Consistent with USACE funded wetland mapping discussed in **MSB Wetland Management Plan** and **Policy CQ2-4** of **MSB Comprehensive Plan (2005 Update)**.
U.7.3. Patches of locally significant vegetation and sensitive habitats not associated with riparian and wetland areas are inventoried and mapped by a qualified biologist.						X	Consistent with **Policy PO2-3** of **MSB Comprehensive Plan (2005 Update)**.
U.7.4. Riparian habitat across the site is maintained, restored, and unimpeded by structures or improvements.							Besides setbacks from buildings and septic tanks, the MSB Code has no regulations protecting riparian zones. See **4.3(C)** of **MSB Stormwater Management Plan**. This standard would be applicable as "above compliance" guidelines.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
U.7.5. Impacts to wetlands are avoided; if impacts cannot be avoided, then are protected, restored or recreated.						X	Jurisdictional wetlands are protected by USACE Section 404 permits: Individual and General. Consistent with **MSB Code 23.05.075**. This standard would be applicable as "above compliance" guidelines.
U.7.6. Riparian zones and their buffers specified in performance requirements are operating in a properly functioning condition.							Besides setbacks from buildings and septic tanks, the MSB Code has no regulations protecting riparian zones. See **4.3(C)** of **MSB Stormwater Management Plan**. This standard would be applicable as "above compliance" guidelines.
U.7.7. Wetlands and buffers specified in performance requirements are operating in a properly functioning condition.						X	Consistent with USACE Section 404 permits: Individual and General.
U.7.8. Sensitive natural resources are protected during construction.							This standard would be applicable as "above compliance" guidelines.
U.7.9. Develop a post-construction inspection and maintenance plan to ensure that riparian and wetland features are in a properly functioning condition.							This standard would be applicable as "above compliance" guidelines.
AC.1. Additional Context-Dependent Certification Considerations							
AC.1.1. Use soft shoreline and armoring techniques in place of bulkheads or traditional bank armoring.							This standard would be applicable as "above compliance" guidelines.
AC.1.2. Reduce the amount of over-water structure by reducing walkway widths, using grated decking material and elevating walkways.							This standard would be applicable as "above compliance" guidelines.

Summary of Gap Analysis between Mat-Su Basin Regulatory Requirements for Development and Salmon-Safe Standards

Salmon-Safe Urban Standard	Existing Regulations						Notes / Gaps Regarding Potential "Above Compliance" Standards
	Building & Site Development	Pollution Prevention	Sewage Siting, Disposal & Treatment	Dam/Stream Crossing	Instream Habitat Protection	Riparian/Wetland Vegetation Protection	
AC.1.3. Reduce the amount of in-water structures by decreasing the diameter of piles, increasing the distance between piles, and using boat lifts.							This standard would be applicable as "above compliance" guidelines.
AC.1.4. Minimize the amount of artificial lighting along the shoreline. If artificial lighting is required for safety purposes, minimize the amount of light that is directed onto the water or towards the night sky, reduce the intensity of lighting, and restrict the duration of lighting.							This standard would be applicable as "above compliance" guidelines.
AC.1.5. Designate parking areas for recreational vehicles outside riparian, wetland and stream buffer areas.							This standard would be applicable as "above compliance" guidelines.
AC.1.6. Use public water supply rather than private well, and promote rainwater collection or harvest with increase in impervious surface.							This standard would be applicable as "above compliance" guidelines.

[1] MSB (Matanuska-Susitna Borough)

[2] ADNR (Alaska Department of Natural Resources)

[3] USDA NRCS (US Department of Agriculture, Natural Resources Conservation Service)

[4] USACE (US Department of the Army, Corps of Engineers)

Italics* = *proposed bill, not yet made statute. *Identified through independent research; not included in documents provided by The Nature Conservancy.*

Prepared July 2017

Appendix D Site Inventory Summary

Appendix D | Site Inventory Summary

Below is a list of typical documentation and plans required for inventorying and mapping to inform a Salmon-Safe design process.

Site Inventory Information

The site information shall ideally consist of maps and explanatory text documenting habitat features on the site as described in the Guidelines text of this document.

This includes:

- Existing stream channels and riparian buffers
- Existing wetlands and buffers
- Existing channel deficiencies
- Stream crossings
- Channel migration zones
- Floodplains
- Soils and slopes
    - Soil types
    - Presence of hydric soils
    - Infiltration rates
    - Erosion factors, including unstable soils
    - Existing erosion and sedimentation problem areas
    - Existing slumps or failures
    - Steep slopes
- Existing drainage patterns
    - On-site: drainage paths, areas of infiltration, discharges to streams or wetlands, and location of flow control facilities
    - Off-site: resources entering the site from an adjacent property
- Opportunities for stormwater harvesting, water reuse and/or wastewater reclamation

Appendix E Construction-Phase Pollution Prevention Checklist

Appendix E | Construction-Phase Pollution Prevention Checklist

Below is a list minimum requirements for a site seeking to protect water quality during construction.

Erosion and sediment transport

The construction site is managed to avoid, or minimize to the maximum extent possible, the release of sediments through the use of the following measures.

Construction management best management practices (BMP's) have been emphasized, including:

1. Maintain existing vegetation cover as long as possible, if it exists;
    - Perform ground-disturbing work in the season with smaller risk of erosion, and work off disturbed ground in the higher risk season;
    - Limit ground disturbance to the amount that can be effectively controlled temporarily in the event of rain;
    - Use natural depressions and planning excavation to drain runoff internally and isolate areas of potential sediment and other pollutant generation from draining off the site, so long as safe in large storms;
    - Schedule and coordinate rough grading, nish grading, and erosion control application to be completed in the shortest possible time overall and with the shortest possible lag between these work activities.
2. Site has been stabilized with cover appropriate to site conditions, season, and future work plans, e.g.:
    - Rapidly stabilize disturbed areas that could drain off the site, and that will not be worked again, with permanent vegetation supplemented with highly effective temporary erosion controls until achievement of at least 90 percent vegetative soil cover;
    - Rapidly stabilize disturbed areas that could drain off the site, and that will not be worked again for more than three days, with highly effective temporary erosion controls;
    - If 0.1 inch of rain or more is predicted with a probability of 40 percent or greater, before rain falls stabilize or isolate disturbed areas that could drain off the site, and that are being actively worked or will be within three days, with measures that will prevent or minimize to the greatest extent possible the transport of sediment off the property.
3. As backup for cases where all of the above measures are used to the maximum extent possible but sediments still could be released from the site, consider the need for sediment collection systems including, but not limited to, conventional settling ponds and advanced sediment collection devices such as polymer-assisted sedimentation and advance sand filtration.

4. Specify emergency stabilization and/or runoff collection (e.g., using temporary depressions) procedures for areas of active work when rain is forecast.

5. If runoff can enter storm drains, use a perimeter control strategy as backup where some soil exposure will still occur, even with the best possible erosion control (above measures) or when there is discharge to a sensitive water body.

6. Specify flow control BMP's to prevent or minimize to the extent possible:

    - Flow of relatively clean off-site water over bare soil or potentially contaminated areas;
    - Flow of relatively clean intercepted groundwater over bare soil or potentially contaminated areas;
    - High velocities of flow over relatively steep and/or long slopes, in excess of what erosion control coverings can withstand;
    - Erosion of channels by concentrated flows either by using channel lining, velocity control, or both.

7. Specify stabilization of construction entrance and exit areas, provision of a nearby tire and chassis wash for dirty vehicles leaving the site with a wash water sediment trap, and a sweeping plan.

8. Specify construction road stabilization.

9. Specify wind erosion control.

Other pollutants

Manage construction sites to avoid the release of pollutants other than sediments by preventing contact between rainfall or runoff and potentially polluting construction materials, processes, wastes, and vehicle and equipment fluids by such measures as enclosures, covers, and containments, as well as berming to direct runoff.

Appendix F Resource Guide

Appendix F | Resource Guide: Professional Disciplines to Call for Specific Projects

Stream Health Analysis	Biologist, Geotechnical Engineer
Vegetation Removal from Stream	General Contractor
Stormwater Analysis	Landscape Architect
Wildlife Impact Analysis	Wildlife Biologist
Sustainable Land Development	Landscape Architect
Infrastructure Development	Civil Engineer
Site Surveying and Mapping	Surveyor
Land Valuation	Property Appraisal Specialist
Site inventory and Mapping	Landscape Architect
Site Design and Layout	Landscape Architect
Site Construction	General Contractor
Post-Construction Operation and Maintenance	Licensed Specialty Contractor

NOTE: Unless specifically exempt under Alaska Statute (AS) 08.48.331, all projects which require the involvement of architects, engineers, land surveyors and/or landscape architects must utilize only registered professionals. For additional clarification on these professions, please refer to the following Alaska Board of Registrations for Architects, Engineers and Land Surveyors' (AELS) Statutes and Regulations:

- AS 08.48.341 Definitions
- Alaska Administrative Code (AAC) Title 12, Chapter 36, Article 2—Professional Code of Conduct (12 AAC 36.200–.250)
- 12 AAC 36.990 Definitions

Available on the AELS web site:

https://www.commerce.alaska.gov/web/cbpl/ProfessionalLicensing/BoardofArchitectsEngineersandLandSurveyors.aspx

For information regarding the regulation of other professions included in the above list, please refer to the State of Alaska, Department of Commerce, Community and Economic Development's Division of Corporations, Business and Professional Licensing web site:

https://www.commerce.alaska.gov/web/cbpl/

Report & Cover Design | Jay Tracy Studios Cover Illustration & Program Icons | Jake / Salmon-Safe
Photo (Page 22) | *Alaska Fireweed,* © PolarTREC (Teachers & Researchers Exploring and Collaborating) : www.polartrec.com


SALMON
SAFE