MAT-SU BASIN SALMON HABITAT PARTNERSHIP
2013-2017 ACCOMPLISHMENTS REPORT

Compiled by Kelly Ingram Pierson, The Nature Conservancy, with information from Partners

The Mat-Su Basin Salmon Habitat Partnership's (the Partnership) broad goals are to protect salmon and their habitats in the Mat-Su Basin and Upper Cook Inlet, mitigate threats to salmon and their habitats, restore connectivity between salmon habitats, and increase knowledge about salmon and their use of freshwater and marine habitats. The strategies for the Mat-Su Basin echo those that the National Fish Habitat Partnership uses to guide work at the national and partnership level.

The Partnership developed its Strategic Action Plan (SAP) to identify collaborative projects and other actions that will protect and restore important habitat for wild salmon in the Mat-Su Basin. The Steering Committee identified three specific purposes for the SAP:

- Identify important habitats for salmon and other fish species in the Mat-Su Basin;
- Prioritize fish habitat conservation actions, including protection, enhancement, and restoration of key habitat, education and outreach, research, and mitigation; and
- Identify potential collaborations and funding sources for partners to address fish habitat conservation.

The Partnership identified 12 conservation strategies to conserve salmon and salmon habitat in the Mat-Su during its 2013 SAP update process. Conservation strategies are composed of objectives, which define a vision of success, and strategic actions that achieve the objectives.

1. Overarching Science Strategies*
2. Alteration of Riparian Areas*
3. Climate Change
4. Culverts that Block Fish Passage*
5. Filling of Wetlands*
6. Impervious Surfaces and Stormwater Pollution
7. Aquatic Invasive Species*
8. Large-scale Resource Development
9. Loss or Alteration of Water Flow or Volume
10. Loss of Estuaries and Nearshore Habitats
11. Motorized Off-road Recreation
12. Wastewater Management

Strategies noted with a * indicate priority strategies. These strategies were ranked based on input from the Mat-Su Salmon Science and Conservation Symposium (Symposium), input from the Partnership's Science and Data Committee, and an algorithm ranking from the Conservation Action Planning process. In 2017, Aquatic Invasive Species was added as a priority due to urgency of action needed.

Methodology: Review of Progress and Accomplishments

As part of the 2018 SAP update process, the Partnership assessed what progress Partners are making toward implementing the SAP. Information for this review was gathered from descriptions of projects funded through the National Fish Habitat Partnership, Symposium presentations from 2013 to 2017, subject matter experts, and from an array of Partner publications. Gathered information was put into an accomplishments spreadsheet compiled by The Nature Conservancy (TNC) and organized to the strategic action level.

This report aims to synthesize the multitude of information and tremendous work done by Partners over the last five years from 2013 to 2017. *Section 1* includes a brief narrative about each objective with significant accomplishments and/or efforts to note. Narratives describe overall progress or the most significant work towards that objective and associated strategic actions. The narratives do not include information about all Partner work and effort. An accomplishments spreadsheet compiled by TNC has more detailed information about specific projects from the wide array of Partners. Section 1 also notes data gaps that were discussed during conversations with subject matter experts that are needed to adequately address conservation strategies as laid out in the 2013 SAP.

Sections 2 and *3* relate objectives to effort levels. *Strong effort* indicates that objectives are completed or on target to be fulfilled in the time period laid out in the SAP. These objectives have greater progress, often with multiple Partners working on these issues. *Moderate effort* indicates that Partners have been working in these areas though to a lesser extent than listed above. Though objectives have had significant effort, they may not be on track to be fulfilled as laid out in the SAP. *Low effort* indicates that there has been some work by a small number of Partners, but objectives could be strengthened by additional support to fulfill these objectives in the future. *Efforts not begun* indicates that, based on our knowledge, Partners are not currently working towards these objectives due to a lack of resources or because these objectives are not an organizational priority. Table 2 groups objectives based on strategy and effort, whereas Table 3 groups objectives based on effort level.

Section 1: Progress Towards Objectives

1. Overarching Science Strategies*

Objective 1.1 Anadromous Waters Catalog (AWC)

By 2020, ensure that all anadromous fish habitat in the Mat-Su Basin is included in the Anadromous Waters Catalog and thus given basic protections afforded under state law. Efforts to catalog anadromous fish should identify life stage information and document non-anadromous fish.

As of April 2018, 889 streams totaling 4,756 miles are in the AWC for the Mat-Su Basin. This represents 9% of all stream miles in the Mat-Su or 28.9% of all stream miles *under 1,000 feet* (3,467 of 11,982 miles). These results were refined utilizing new National Hydrography Database (NHD) stream mapping completed in 2015 that doubled the stream miles in the Mat-Su. The new stream lines were nominated to the AWC in 2017 and will result in the update of 809 streams covering 4,759 miles for the AWC in the Mat-Su.

Objective 1.2 Habitat Quality

By 2020, characteristics of habitats that are critical for salmon at each life stage (spawning, rearing, and overwintering) will be identified and used to develop critical habitat definitions to identify places that provide these habitats.

Significant knowledge has been gained about relative abundance for summer rearing in many systems across the Mat-Su, and particularly in the Big Lake watershed. The Susitna-Watana Hydroelectric Project environmental assessments greatly increased our knowledge along the Susitna River. Knowledge was also gained about overwintering habitat for Coho in the Big Lake Watershed and along the Susitna, though there is still much more to understand. In 2016, TNC published *Landscape-scale mapping of Pacific salmon and their freshwater habitats in the Mat-Su Basin*, modeling potential habitats for salmon across the Mat-Su. The idea of "critical habitat" may need to be revisited as salmon have been found in every stream type throughout the Mat-Su over a range of physical habitat conditions.

Objective 1.3 Surface and Groundwater Studies

By 2018, an increased understanding of surface and groundwater exchange, including locations, quantities, flows, and variability in the Mat-Su Basin, will be sufficient to aid in identifying critical salmon habitat for each life stage.

Following their preliminary water table report in 2005, U.S. Geological Survey (USGS) further mapped, created a model of groundwater, and evaluated the surface and subsurface interactions in *Shallow Groundwater in the Mat-Su Valley, AK – Conceptualization and Simulation of Flow* in 2013. Using this study, knowledge was gained about dry-period stream flows with initial results by Kenai Watershed Forum (KWF) indicating that 50-75% of water in wetlands streams in mid-summer are from adjacent wetlands themselves. The Mat-Su Wetland Hydrology Project by U.S. Fish and Wildlife Service (USFWS), Mat-Su Borough (MSB), and USGS is refining the 2013 model to identify key wetlands contributing to base flow of anadromous streams.

Objective 1.4 Water Quality Monitoring

By 2018, a comprehensive baseline and monitoring program for water quality exists to track and manage changes in Mat-Su Basin waterbodies.

Individual projects have significantly increased our water quality knowledge, especially in Cottonwood Creek and Big Lake, the lower Little Susitna River, the Deshka River, Willow Creek and Lake Lucille, though a comprehensive baseline and monitoring program has not been established. There are currently 5 impaired waterbodies not meeting Alaska Department of Environmental Conservation (ADEC) water quality standards for freshwater aquatic life – 4a: Cottonwood Creek, Matanuska River;

4b: Little Susitna River 8.5 river miles; 5: Little Susitna River 8.5 river miles, Lake Lucille 5.6 acres. The MSB retired the Volunteer Lake Monitor Program in early 2018.

Objective 1.5 Index Watersheds

By 2016, a minimum of three index watersheds are locations for long-term, interdisciplinary monitoring needed to understand the relationships between salmon, habitat health, and changes induced by human activities and climate change.

The Science and Data Committee is in the process of compiling which watersheds have existing data. This compilation will be used to construct a decision matrix to inform which watersheds are suitable as index watersheds based on Partnership priorities. The Bureau of Land Management Assessment, Inventory, and Monitoring (AIM) framework is being evaluated as a model for finding and assessing long-term change.

2. Alteration of Riparian Areas*

Objective 2.1 Identification of Priority Riparian Areas

By 2018, 50% of salmon riparian areas will be field surveyed, mapped and prioritized for long-term legal protection and/or restoration.

Great Land Trust (GLT) and Partners identified 35 priority waterbodies and prioritized private parcels for conservation in 2014, comprising approximately 1,690 stream miles or 3,380 miles of riparian length. Of these, 1,381 stream miles or 2,688 miles of riparian length were determined as priority areas *below 1,000 feet*. An assessment of impacted riparian areas of the 35 priority waterbodies was completed in 2015 by USFWS and Palmer Soil and Water Conservation District (PSWCD), concluding that an estimated 23 miles of riparian length has been impacted.

Objective 2.2 Protection of Priority Riparian Areas

By 2018, secure long-term protective status (e.g., conservation easements, designated parks, land acquisition) of at least 10% of priority riparian habitats that have not been significantly altered.

GLT has conserved 8,569 acres of private lands in the Mat-Su since 2000, protecting 37 miles of *priority* riparian habitat. Of these 8,569 acres, 2,333 acres of private lands have been put into long-term protective status by GLT between 2013 and 2017. Including these private protections plus state and local parks, 198 miles or 7.46% of *priority* riparian length *below 1,000 feet* is in long-term protective status as of 2017. In 2017, an ordinance for a 50-foot riparian buffer on MSB land was proposed but did not pass through MSB Planning Commission and Assembly.

Objective 2.3 Restoration of Priority Riparian Areas

By 2018, 5% of priority riparian habitats that have been altered are restored.

Between 2005 and 2017, over 2 miles of riparian habitat were restored in the Mat-Su Basin, restoring an estimated 5-8% of impacted riparian areas. Streams were prioritized in 2014, and an assessment of impacts to those priority streams was completed in 2015. Analysis has not yet been done to identify the percentage of *priority* riparian habitat restored, though that is expected to take place in 2018. USFWS and ADFG are currently working to prioritize restoration projects on impacted streams. In 2015, ADFG produced a narrative inventory of factors impacting riparian habitat in the Mat-Su and possible studies to better understand those impacts.

3. Climate Change

Objective 3.1 Comprehensive Baseline and Monitoring for Stream Temperatures

By 2015, comprehensive baseline and monitoring program for stream temperatures exists to track and manage changes in priority Mat-Su Basin waterbodies and impacts on salmon and salmon habitat.

Multiple Partner projects have expanded our understanding of current and future stream temperatures across the Mat-Su Basin, with intensive work occurring in the Big Lake and Deshka River watersheds. In 2017, Cook Inletkeeper (CIK) et al. published an analysis of continuous air and stream temperature data in 48 nonglacial salmon streams across Cook Inlet from 2008 to 2012. In 2018, Alaska Center for Conservation Science et al. produced *Characterization of Stream Thermal Regimes in the Matanuska-Susitna Basin* and maintains Alaska Online Aquatic Temperature Site (AKOATS): a comprehensive inventory of current and historic stream and lake temperature monitoring locations. CIK continues to coordinate the Cook Inlet Stream Temperature Monitoring Network, which includes four long-term sites (10+ years) in the Mat-Su Basin. The goal of maintaining a comprehensive monitoring program across a wide range of watersheds is being minimally met and could be expanded in the future.

Objective 3.2 Integrate Climate Change into Priorities

By 2015, integrate climate change into habitat conservation strategies and prioritizations.

While there has been significant work to understand cold water refugia and changing water temperatures in the Mat-Su, the Partnership has not done comprehensive planning to incorporate climate change into strategies, with the exception of prioritizing habitat connectivity. However, plans are underway by CIK and USFWS to hold a workshop on this topic in 2018.

4. Culverts that Block Fish Passage*

Objective 4.1 No New Barriers

By 2015, effective fish passage is maintained at new road crossings through improved coordination between agencies, sufficient resources for applying current state statutes, and use of improved design and construction practices for effective fish passage.

The MSB Assembly adopted fish-friendly design standards in August 2013, and since then, there have been no new barriers at road-stream crossings on MSB roads! Alaska Department of Transportation and Public Facilities (ADOT&PF) roads and the Alaska Railroad (ARR) are held to lesser fish passage design standards, and the Memorandum of Understanding between ADFG and ADOT&PF is now 17-years old.

Objective 4.2 Fish Passage Restoration

By 2015, fish passage will be restored in 65 priority culverts that currently block passage of juvenile or adult fish.

An inventory and prioritization of culverts blocking fish passage was completed by partners in 2011. USFWS completed a cost-benefit analysis and prioritization of culverts blocking fish passage in 2016. 95% of known existing public and private culverts have now been assessed for impacts to fish passage. As of 2017, 40% of these known culverts are open to fish passage and 55% of stream miles are open. Since 2001, 109 culverts have been replaced. Since 2013, 15 have been replaced, opening 1,256 lake acres and 83 miles of streams to fish passage.

5. Filling of Wetlands*

Objective 5.1 Identify, Map and Assess Functions of Wetlands for Salmon

By 2018, wetlands that are important for salmon will be identified, mapped and assessed for their functional importance for salmon.

Over 1 million acres of MSB wetlands were evaluated for presence and type by overlaying areas of future urban and rural development with wetlands. Based on this effort, MSB completed *Matanuska-Susitna Wetland Functions and Values Landscape-Level Assessment Methodology and Mapping* in 2014, which included mapping of wetlands important for salmon within this 1-million-acre area. KWF completed a wetland loss assessment for the Expanded Core Area in 2018, indicating that while less than 2% of the overall area of wetlands have been filled, many wetland types have been filled at a disproportionately higher rate. Based on wetland mapping completed in 2011, the MSB developed an online wetlands map viewer describing different wetland types over 450,000 acres between Palmer and Houston. A recurring imagery program that includes for tracking wetland loss in the future is planned to begin in 2018 by MSB.

Objective 5.2 Conserve Wetlands for Salmon

By 2020, loss of wetlands that are important for salmon either as spawning or rearing habitat, re-charge of streams, or filtration of streams, will be avoided, minimized, or mitigated with protection, management, and enhancement.

GLT has secured long-term protective status on 4,834 wetland acres since 2000, including 1,517 acres between 2013 and 2017. Goals of the MSB Wetland Management Plan are being implemented through public outreach and project support to understand wetland function, values and loss in the Mat-Su. The MSB and Su-Knik Environments, LLC have a Wetlands Mitigation Bank and partner with GLT for conservation easements. GLT also has an in-lieu fee wetlands program to leverage mitigation dollars for greater conservation impact. The U.S. Army Corps of Engineers has significantly decreased required mitigation plans for developments in recent years.

6. Impervious Surfaces and Stormwater Pollution

Objective 6.1 Minimize Impacts on Water Quality

By 2018, new housing and urban development sites will not result in stormwater runoff that alters the quantity or quality of water in streams and lakes. All water flowing into salmon habitat will equal or exceed the quality necessary to protect the growth and propagation of fish as determined by state water quality standards for aquatic life.

Two projects on Cottonwood and Vine Creeks conducted stormwater infrastructure and needs analysis to reduce impacts to water quality. The MSB produced its Stormwater Management Plan in 2013 and Salmon-Safe development guidelines were released in 2018, providing Best Management Practices (BMPs) for minimizing stormwater impacts. Partners are still gathering information about impervious surface impacts to Mat-Su waterbodies and how they influence water quality (see Objective 6.3). Changes to development practices are on a voluntary basis.

Objective 6.2 Minimize Road Runoff

By 2018, the extent and potential of road runoff as a contributor to water quality issues at salmon streams will be known and BMPs developed to minimize impacts.

BMPs for minimizing road runoff impacts have been developed through the MSB's Stormwater Management Plan and Salmon-Safe development guidelines, but these BMPs need to be further implemented. We have the fundamental datasets to complete a road runoff evaluation with the 2015 NHD update.

Objective 6.3 Imperviousness Impact Assessment

By 2018, understand the magnitude of impact of impervious surfaces and stormwater runoff in the most developed watersheds.

TNC completed an impervious surface map for the Mat-Su in 2011, though this should be an iterative mapping process as development expands. With the NHD update in 2015, the fundamental datasets are available to map stormwater drainage networks. A number of studies assessed runoff impacts to water quality in Cottonwood, Vine, Wasilla, Meadow, and Willow Creeks and Lake Lucille.

7. Aquatic Invasive Species (AIS)

This strategy focuses on northern pike and elodea (found in the Mat-Su in 2014).

Objective 7.1 Prevention

By 2016, identify potential vectors for introducing or spreading AIS in the Mat-Su and conduct outreach to inform and influence target audiences so that their activities do not introduce or spread AIS.

University of Alaska Anchorage Institute of Social and Economic Research (UAA ISER) recently completed an aviation pathways analysis for elodea, but waterbodies at high risk still need to be prioritized. The Alaska Department of Agriculture is in the process of amending current Plant Health and Quarantine Regulations, adding five aquatic plants to the Noxious Weed listing, including two types of elodea. A vulnerability assessment of Mat-Su drainages to pike is underway by a University of Alaska Fairbanks (UAF) graduate student. Individual partners have also conducted public outreach to prevent the spread of AIS.

Objective 7.2 Early Detection and Surveillance

By 2015, periodic surveillance surveys designed to have a high likelihood of detecting AIS at an incipient stage of infestation will be completed at priority waterbodies. Priorities are determined based on level of risk for introduction of AIS.

Partners conducted surveys in their focus areas for elodea presence, and remote float plane lake surveys will take place in 2018 and 2019, though a formal collaborative survey program is not in place. ADFG will be prioritizing proactive monitoring for pike based on the results of the UAF pike vulnerability assessment currently underway. Research is also underway to understand pike presence and juvenile salmon vulnerability to pike using eDNA.

Objective 7.3 Rapid Response

By 2015, procedures are in place to respond rapidly to any newly discovered introductions or to newly detected expansion of existing AIS.

An elodea rapid response plan is in progress with Alaska Department of Natural Resources, ADFG, USFWS, NOAA and ADEC. Treatment permitting at the state and federal levels for response is challenging, as is funding. Sharing of herbicide supplies has helped with response efforts, though additional flow data is needed to adequately treat lakes with significant influx of water for elodea, such as Alexander and Sucker Lakes. About 120 waterbodies have northern pike, and a number of suppression efforts have been underway (see Objective 7.4).

Objective 7.4 Control

By 2015, an effective program of integrated pest management for invasive species is developed and implemented, including elements of containment, eradication, control, and restoration.

Elodea is known to be in Alexander and Sucker Lakes in the Mat-Su. Treatment aimed at eradication took place in Alexander Lake in 2016 and 2017 but was not successful due to a lack of data on water flow. Flow data collection for Alexander Lake is planned for 2018. About 120 waterbodies are known to have pike in the Mat-Su, and projects are underway to suppress pike through gill netting, liberalizing harvests, and public outreach. Locations of pike suppression efforts include Alexander Creek, Chelatna Lake, Anderson and Kings Lakes, Hewitt and Whisky Lakes, Shell Lake, and Threemile Lake near Tyonek.

Targeted piscicide applications for pike eradications have been discussed. A Management Plan for Invasive Northern Pike in Alaska was prepared by Southcentral Alaska Northern Pike Control Committee in 2015.

8. Large-scale Resource Development

The most prominent large-scale project over the 2013-2017 timeframe was the Susitna-Watana Hydroelectric Project. Comments about these objectives primarily relate to Partner responses to this project.

Objective 8.1 Education and Outreach about Large-scale Resource Projects

By 2017, the public will have access to information about proposed large-scale resource development projects and their potential to affect salmon and their habitats.

Partners engaged in significant outreach to the public about the Susitna-Watana Hydroelectric Project regarding the potential impacts of the project to salmon populations, the licensing/permitting process, and ways to become involved in the process.

Objective 8.2 Agency Assistance for Large-scale Resource Projects

By 2017, state and federal agencies and stakeholders involved in permitting processes for large-scale resource development projects have the data, analytical tools, and expertise that they need to understand the potential to affect salmon and their habitat.

Partners provided significant data, analytical tools and expertise throughout the Susitna-Watana Hydroelectric Project review process, including potential impacts to salmon and their habitat. This includes individual Partner research, feedback through the technical workgroups, and TNC's Ecological Risk Assessment, among other actions.

Objective 8.3 Address Data Gaps

By 2017, data gaps for large-scale resource development projects will be identified and filled as feasible for the licensing and permitting processes.

Significant data was gathered that fed into studies and modeling related to water resources and quality, instream flow, habitat, fish distribution, wetland mapping, riparian impacts, and others. Partners also provided feedback about data gaps and research through technical workgroups and individual comments.

9. Loss or Alteration of Water Flow

Objective 9.1 Instream Flow on Anadromous Waters

By 2020, partner organizations have filed applications for reservations of water with ADNR to preserve the flow regimes of priority anadromous lakes and streams.

Between 2013 and 2017, 19 water reservations were filed for the Mat-Su, with 8 of those granted. To date, 47 reservations have been filed for over 500 miles of streams. Of those filed, 24 have been granted on approximately 270 miles of stream. USFWS, USGS and ADFG prioritized 39 streams in 2016 for future water reservations based on TNC's salmon habitat quality and vulnerability mapping. All USGS stream gages with partial records have been filled out with additional data and filed, therefore new data on new streams will need to be collected before new reservations can be filed.

Objective 9.2 Community Water Needs Study

By 2020, current and future use and need of ground and surface water by Mat-Su Basin communities are quantified in order to assess impacts to water quantity.

One USGS study investigated the shallow groundwater system in the Mat-Su Valley, providing information about aquifer-system storage in response to climate change and development. This study

estimated an aquifer water withdrawal of 5,800 acre-feet per year by domestic, community and municipal wells. Questions remain related to projecting future water needs and improved modeling.

10. Loss of Estuaries and Nearshore Habitats

Objective 10.1 Salmon Ecology of Cook Inlet

By 2018, implement the Knik Arm Salmon Ecology Integrated Research Plan (HDR, 2010) to significantly improve the understanding of salmon ecology in Knik Arm.

A data gap analysis of study needs for salmon and beluga in Cook Inlet was completed in 2016 that provided an overview of salmon life history including the estuarine environment, stock assessments in Cook Inlet, and data needed in the future. ADFG is conducting genetic stock identification on commercial coho and Chinook in Cook Inlet. In 2009, ShoreZone habitat mapping was completed, but the data does not go fully up Knik Arm and has not been related to salmon habitat types at this time. A comprehensive study of Cook Inlet habitat types and salmon habitat use has not been completed to significantly improve our understanding of salmon ecology in Knik Arm.

Objective 10.2 Conserve Estuaries for Salmon

By 2018, assure no long-term impairments of vulnerable coastal habitats from incompatible shoreline developments.

GLT completed an assessment of estuaries and their conservation status and has implemented long-term protections through 6 conservation projects in Cook Inlet since 2000. Of the 18 estuaries in Knik Arm, GLT has worked with partners to conserve 7 and provide partial protection to 4 more. The MSB Stormwater Management Plan and Salmon-Safe development guidelines support water quality improvements related to reducing non-point source pollution into Cook Inlet.

11. Motorized Off-road Recreation

Objective 11.1 Impacts to Salmon and Salmon Habitat

By 2018, qualify the impacts to salmon and salmon habitat from OHV use regarding stream morphology and water quality to specifically determine physical damage to the stream and banks and hydrocarbon and sedimentation inputs to streams.

USFWS/PSWCD's assessment of impacted riparian areas found 188 OHV crossings on priority waterbodies. USFWS mapped and assessed 13 crossings in Knik River Public Use Area for degradation level. USFWS's data fed into an APU master's thesis (in prep) to quantify impacts of ORV stream crossings to turbidity levels. An APU graduate student is currently using imagery to map trails in the Mat-Su over time and quantify erosion and water quality impacts. Though some trails have been mapped, a Basin-wide trail map has not been developed. Mat-Su Trails and Parks Foundation is working on crowdsourcing trail map data from users in 2018.

Objective 11.2 Mitigate OHV Use at Streams

By 2018, establish effective and publicly acceptable mechanisms to support stream health near OHV trails and at stream crossings.

Partners have been involved in a range of actions to mitigate OHV impacts to streams. These include outreach to OHV users through brochures and signage (Baby Salmon Live Here, ADFG brochure), and in-person surveys about users' value of fish in the Mat-Su. Basin-wide mapping and identification of the most impacted stream crossings has not been completed.

12. Wastewater Management

Objective 12.1 Improved Wastewater Disposal

By 2018, septic systems are designed and constructed based on parcel size, number of parcels in a subdivision, and soil suitability, with an emphasis on developing community systems and connecting to public systems, so that septic systems do not contribute to degraded water quality.

Partners have educated the public about Septic Smart systems, though there has been no effort to map septic suitability in the Mat-Su. The MSB Multifamily Housing Code update is in process in 2018, and is proposing an ordinance to implement more oversight on higher density wastewater disposal systems.

Objective 12.2 Expanded Wastewater Infrastructure

By 2018, Mat-Su Borough and its communities have a wastewater infrastructure and treatment facilities that can handle sewage discharges in the Mat-Su Borough.

MSB is exploring the process to construct a septage and leachate treatment facility to address the disposal of septage created by 93% of MSB residents who rely on septic tanks for wastewater disposal. ADEC approved a loan to begin this project, and design work began in 2017.

Objective 12.3 Wastewater Pollution Prevention

By 2018, quantify the extent and sources of possible wastewater pollution to surface and ground waters from on-site septic systems and wastewater discharge.

ADEC has conducted bacteria and nutrient water quality monitoring in Willow Creek (and several others prior to 2013). They also completed a Total Maximum Daily Load (TMDL) water quality recovery plan for Cottonwood Creek bacteria pollution. ADEC and MSB have implemented the TMDL by conducting stormwater inventory analyses on Cottonwood and Vine Creeks paired with Septic Smart outreach and septic pumping neighbor discounts. ADEC is currently working with PSWCD to digitize and map on-site septic disposal systems along Cottonwood Creek. There are no ongoing studies to quantify the extent and sources of possible wastewater pollution to surface and ground waters from on-site septic systems and wastewater discharge.

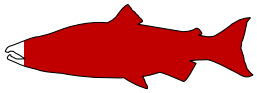
Data Gaps

Through the review process, some gaps in data were brought to attention. Below are a few brief notes that summarize comments from subject matter experts related to data needs in the Mat-Su.

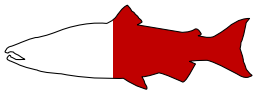
- *Anadromous Waters Catalog* (Strategy 1): Conduct a data gap analysis to assess and prioritize streams under 1,000 feet remaining to be cataloged with a goal to reach 50% of all streams below 1,000 feet in 5 years.
- *Salmon Habitat Model* (S1): Update TNC's salmon habitat model to the new NHD (assigning habitat values to each reach) and validate the model in the field to prove its statistical accuracy.
- *Recurring Imagery* (S5, 6, 11): Acquisition of multi/hyper spectral aerial photography on a repetitive basis (every 2-3 years) would support development tracking related to impervious surfaces, land use land cover, filling of wetlands, and ORV trails.
- *Road Runoff and Impervious Surface Study* (S6) With the 2015 National Hydrography Dataset (NHD) update, we have the fundamental datasets to complete an assessment of road runoff and impervious surfaces.
- *Lake Water Flow* (S7): Accurate water flow data on lakes with significant water flow (Alexander and Sucker Lakes) is essential to successfully treat aquatic invasive species with herbicides.

- *Floodplain/Riparian Areas/Meander Belt Mapping* (S2): An accurate survey of meander belts and riparian zones could be a huge asset in helping the cities and MSB planners understand where not to develop.
- *Community Water Needs Assessment* (S9) Determine if current groundwater sourced community water infrastructure is compatible with climate change, population growth and healthy salmon habitats or if long term planning of new sources of water is required.
- *Cook Inlet Salmon Ecology Study* (S10): Research to better understand salmon habitat use in Cook Inlet to help conserve priority habitat from shoreline development or other threats.
- *OHV Crossing Impact Assessment* (S11): Characterize how OHV crossings impact stream morphology and water quality in salmon habitats.
- *Septic System Mapping* (S12) Develop a map of location and age of septic systems within the Knik-Palmer-Wasilla Core Area. This is underway along Cottonwoood Creek, but additional funding Is needed to expand mapping to the full core area.

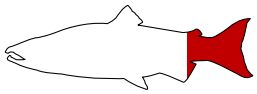
Section 2: Effort Level by Strategy and Objective



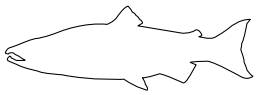
Strong Effort: Many partners have been working in these areas, often with stable funding, to enable action on a steady basis. Multiple partners have been working on these issues, resulting in greater progress towards objectives. Objectives with strong effort are completed or on target to be fulfilled in the time period laid out in the plan.



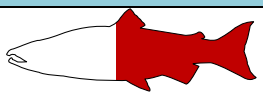
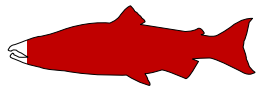
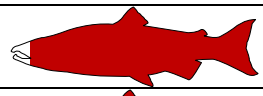
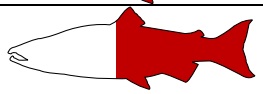
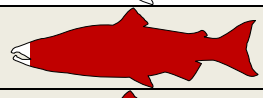
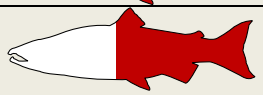
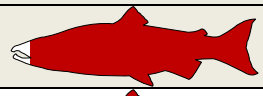
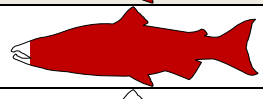
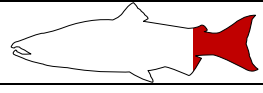
Moderate Effort: Partners have been working in these areas though to a lesser extent than listed above. Though these objectives have had significant effort, they may not be on track to be fulfilled as laid out in the plan.

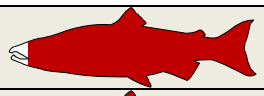
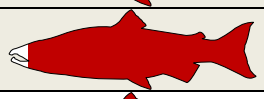
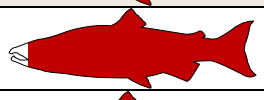
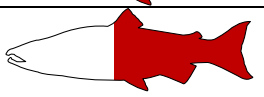
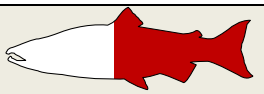
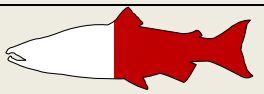
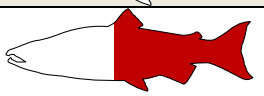
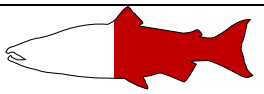
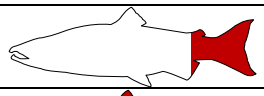
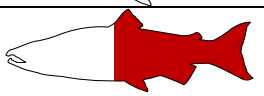
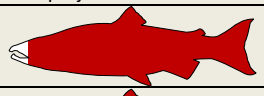
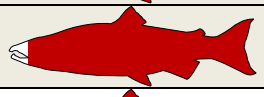
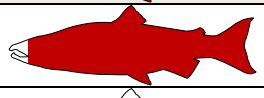
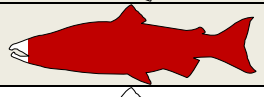
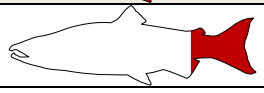


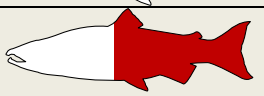
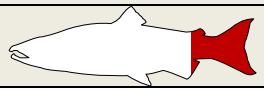
Low Effort: There has been some minimal work by a small number of partners in these areas. These objectives could be strengthened by additional support to fulfill these objectives in the future



Efforts Not Begun: From available resources, these objectives indicate that no partners are working towards these issues at this time.

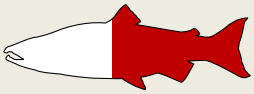
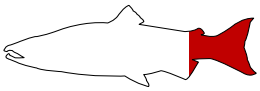
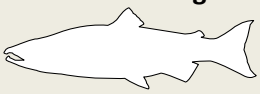
Strategy	Objective	Effort Level
Overarching Science Strategies	Objective 1.1 Anadromous Waters Catalog	
	Objective 1.2 Habitat Quality	
	Objective 1.3 Comprehensive Surface and Groundwater Studies	
	Objective 1.4 Water Quality Monitoring	
	Objective 1.5 Index Watersheds	
Alteration of Riparian Areas	Objective 2.1 Identification of Priority Riparian Areas	
	Objective 2.2 Protection of Priority Salmon Riparian Habitat	
	Objective 2.3 Restoration of Priority Riparian Habitat	
Climate Change	Objective 3.1 Comprehensive Baseline Monitoring Program for Stream Temperatures	
	Objective 3.2 Integrate Climate Change into Priorities	

Culverts that Block Fish Passage	Objective 4.1 No New Fish Passage Barriers	
	Objective 4.2 Fish Passage Restoration	
Filling of Wetlands	Objective 5.1 Identify, Map and Assess Functions of Wetlands for Salmon	
	Objective 5.2 Conserve Wetlands for Salmon	
Impervious Surfaces and Stormwater Pollution	Objective 6.1 Minimization of Impacts on Water Quality	
	Objective 6.2 Minimize Road Runoff	
	Objective 6.3 Imperviousness Impact Assessment	
Aquatic Invasive Species	Objective 7.1 Prevention	
	Objective 7.2 Early Detection and Surveillance	
	Objective 7.3 Rapid Response	
	Objective 7.4 Control	
Large-scale Resource Development	The most prominent large-scale project over the 2013-2017 timeframe was the Susitna-Watana Hydroelectric Project. Comments about these objectives primarily relate to Partner responses to this project.	
	Objective 8.1 Education and Outreach about Large-scale Resource Projects	
	Objective 8.2 Agency Assistance for Large-scale Resource Projects	
	Objective 8.3 Address Data Gaps	
Loss or Alteration of Water Flow	Objective 9.1 Instream Flow on Anadromous Waters	
	Objective 9.2 Community Water Needs Study	
Loss of Estuaries & Nearshore Habitats	Objective 10.1 Salmon Ecology of Cook Inlet	
	Objective 10.2 Conserve Estuaries for Salmon	
Motorized Off-Road Vehicles	Objective 11.1 Impacts to Salmon and Salmon Habitat	

	Objective 11.2 Mitigate OHV Use at Streams	
Wastewater Management	Objective 12.1 Improved Wastewater Disposal	
	Objective 12.2 Expanded Wastewater Infrastructure	
	Objective 12.3 Wastewater Pollution Prevention	

Section 3: Objective by Effort Level

The 12 Strategies outlined in the 2013 SAP are comprised of 33 objectives. Of all 33 objectives, 13 objectives (39%) had strong effort, 10 objectives (30%) had moderate effort, 10 objectives (30%) had low effort, and no objectives had efforts not yet begun. Of the 5 priority strategies (Overarching Science Strategies, Alteration of Riparian Areas, Culverts that Block Fish Passage, Filling of Wetlands, and Aquatic Invasive Species), 7 objectives (44%) had strong effort, 7 objectives (44%) had moderate effort, 2 objectives (12%) had low effort, and none had efforts not yet begun.

Effort Level	Objective
Strong Effort  13 objectives | 39%	O1.2 OAS: Habitat Quality O1.3 OAS: Comprehensive Surface and Groundwater Studies O2.1 Identification of Priority Riparian Areas O2.3 Restoration of Priority Riparian Areas O3.1 Comprehensive Baseline Monitoring for Stream Temperatures O4.1 No New Fish Passage Barriers O4.2 Fish Passage Restoration O5.1 Identify, Map and Assess Functions of Wetlands for Salmon O8.1 Education and Outreach about Large-scale Resource Projects O8.2 Agency Assistance for Large-scale Resource Projects O8.3 Address Data Gaps O9.1 Instream Flow on Anadromous Waters O10.2 Conserve Estuaries for Salmon
Moderate Effort  10 objectives | 30%	O1.1 OAS: Anadromous Waters Catalog O1.4 OAS: Water Quality Monitoring O2.2 Protection of Priority Riparian Habitat O5.2 Conserve Wetlands for Salmon O6.1 Minimization of Impacts on Water Quality O6.2 Minimize Road Runoff O7.1 Aquatic Invasive Species Prevention O7.2 Aquatic Invasive Species Early Detection and Surveillance O7.4 Aquatic Invasive Species Control O12.2 Expanded Wastewater Infrastructure
Low Effort  10 objectives | 30%	O1.5 OAS: Index Watersheds O3.2 Integrate Climate Change into Priorities O6.3 Imperviousness Impact Assessment O7.3 Aquatic Invasive Species Rapid Response O9.2 Community Water Needs Study O10.1 Salmon Ecology of Cook Inlet O11.1 OHV Impacts to Salmon and Salmon Habitat O11.2 Mitigate ORV Use at Streams O12.1 Improved Wastewater Disposal O12.3 Wastewater Pollution Prevention
Efforts Not Begun 	None