2023 Watershed Update

Municipality of Anchorage

Alaska Department of Transportation and Public Facilities

A.laska
P.ollutant
D.ischarge
E.limination
S.ystem

Today's Agenda

APDES Meeting Agenda:

BIRCH Room

9:30 **APDES Storm Water Program**

- Introductions
- Agency Updates

Monitoring Program

- Dry Weather Screening – *Kacy Grundhauser, HDR, Inc.*
- Pesticide Screening – *Josh Buza, HDR, Inc.*
- Stormwater Outfall Monitoring – *Cindy Helmericks, HDR, Inc.*

Watershed Education Activities – *Cherie Northon, AWC*

10:30 **Break for Refreshments**

11:00 **Chester Creek Master Plan – Introduction and Implementation**

Presentation of data collection efforts and the mapping and modeling products. Avenues for implementation into the capital projects process. *Attendees are eligible to receive one PDH credit – Janie Dusel, AWR Eng.*

12:00 **Discussion & Adjournment**

APDES Annual Meeting

Municipality of Anchorage
and Alaska Department of Transportation
and Public Facilities

Agency Updates

WATERSHED MANAGEMENT

APDES Annual Meeting

Municipality of Anchorage
and Alaska Department of Transportation
and Public Facilities

Anchorage Storm Water Permit Compliance

*APDES = Alaska Pollutant Discharge Elimination System

*MS4 = Municipal Separate Storm Sewer System

WATERSHED MANAGEMENT

APDES Annual Meeting

Municipality of Anchorage
and Alaska Department of Transportation
and Public Facilities

Anchorage Storm Water Permit Compliance

MOA & ADOT, owners – Responsible for Water Quality

MS4, Traditionally, In Past, Treated Passively

Doesn't Work when we have a Permit for Management -

WATERSHED MANAGEMENT

APDES Annual Meeting

Anchorage Storm Water Permit Compliance

- Specific Mandated Programs-
- Construction – Erosion & Sediment Control
- New Development – Runoff Quantity Reduction
- Street Operations & Management
- Discharge Management – Residential/Industrial
- Monitoring – Dry & Wet Weather, Pesticides
- Education

Dry Weather Screening

Presented by:

Kacy Grundhauser
HDR, Inc.

Pesticide Screening

Presented by:

Josh Buza
HDR, Inc.

APDES Annual Meeting

Stormwater Outfall Monitoring

Presented by:

Cindy Helmericks
HDR, Inc.

APDES Annual Meeting

Watershed Education Activities

Presented by:

Cherie Northon
AWC

Chester Creek Master Plan Introduction and Implementation

Presented by:

Janie Dusel
AWR Engineering

Illicit Discharge

AMC 21.07.040 – Regulates Discharges to MOA storm drains

- Defines specific prohibited discharges, but also defines “illicit discharge” as “pollutants or any materials other than storm water”.
- Streets drain to creeks - #1 public outreach message
- All drains are not equal - Storm drain flows DO NOT go to the sewage treatment plant

Illicit Discharge

Illicit Discharge

Free Disposal for Household Hazardous Waste

Not sure what to do with that leftover household hazardous waste?

The Anchorage Regional Landfill and the Central Transfer Station accept up to 5 gallons (40 pounds) of household hazardous waste, paint, turpentine, aerosols, poisons, antifreeze, oil, etc. for **FREE!!!**

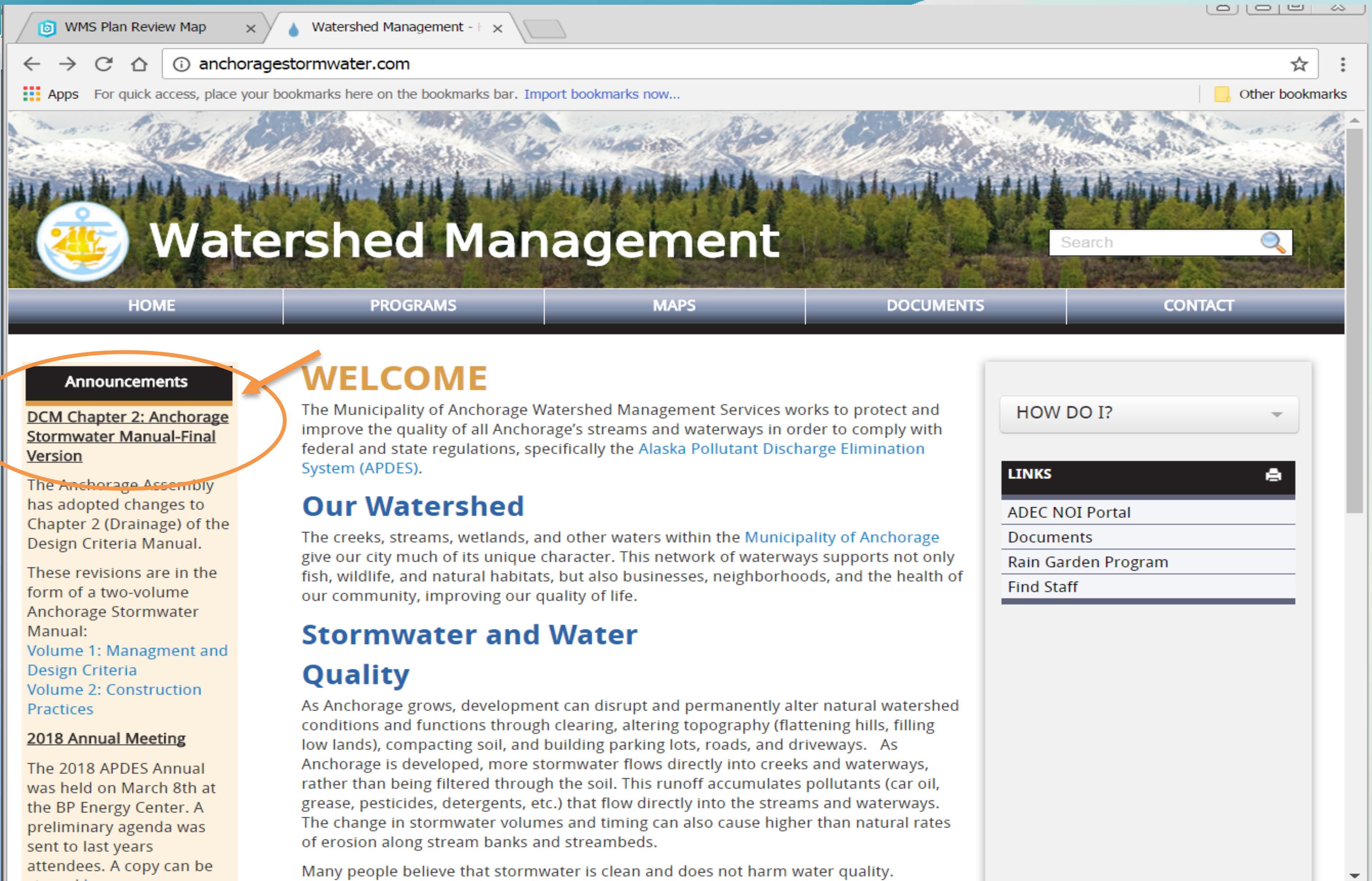
Anchorage Regional Landfill
Glenn Highway & Hiland Road Interchange
Tues – Sat 8 am – 5 pm
428-1742

Central Transfer Station
Old Seward & E. 54th Avenue
Tues, Thurs, Sat 8 am – 5 pm
343-6262

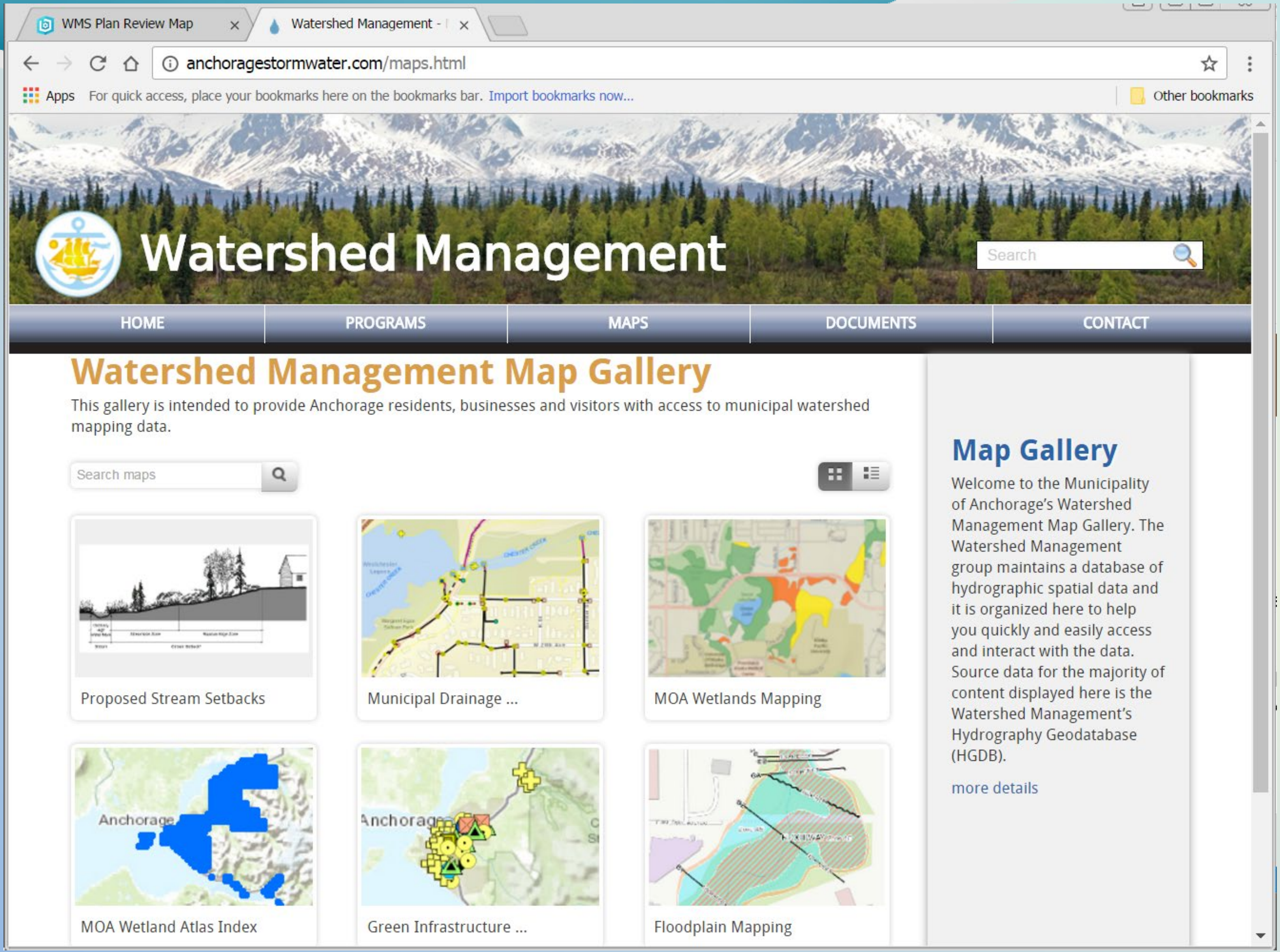
Provided by the Municipal Watershed Management Program

Spill Cleanup

www.AnchorageStormwater.com



www.AnchorageStormwater.com/maps



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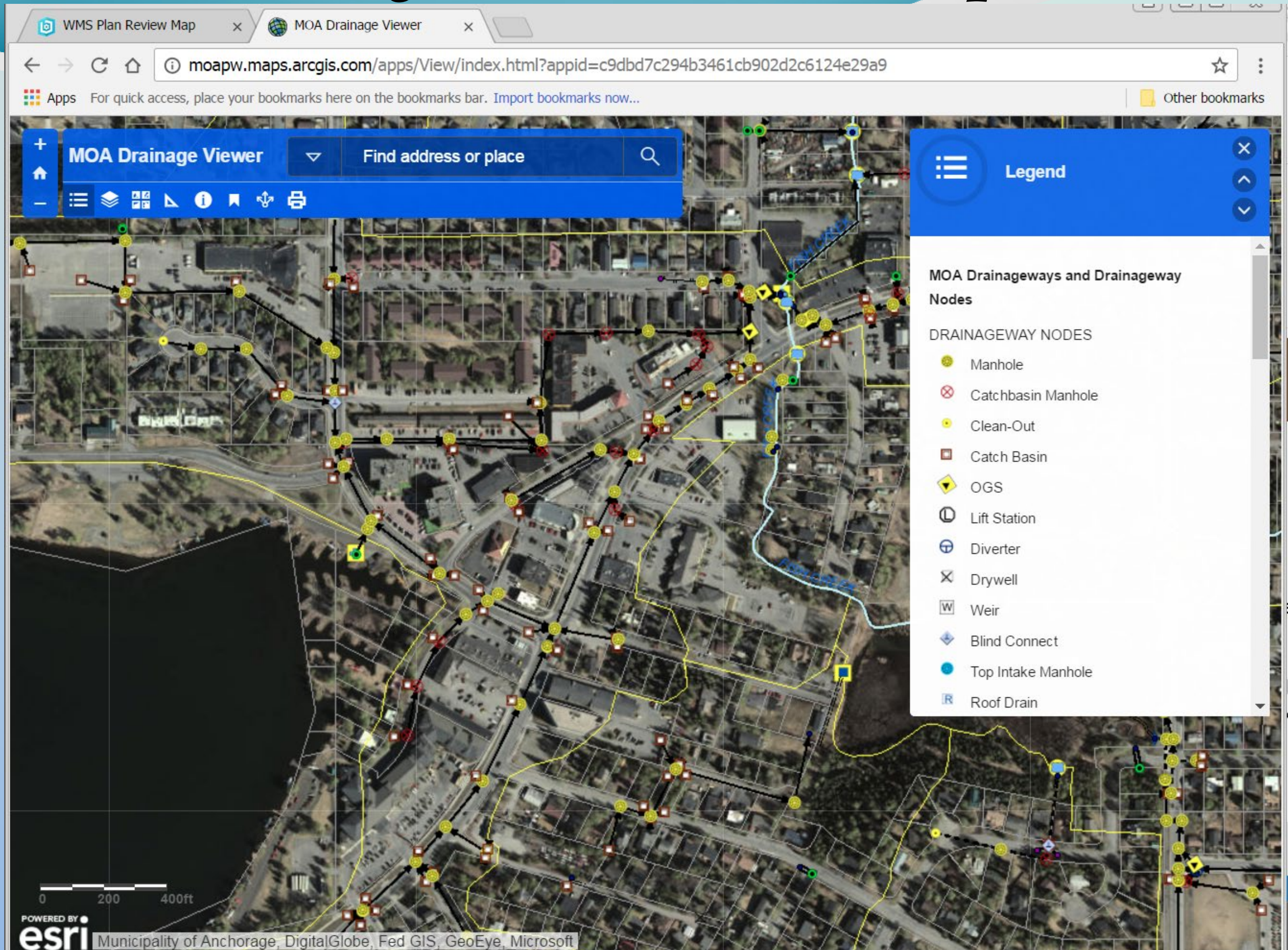
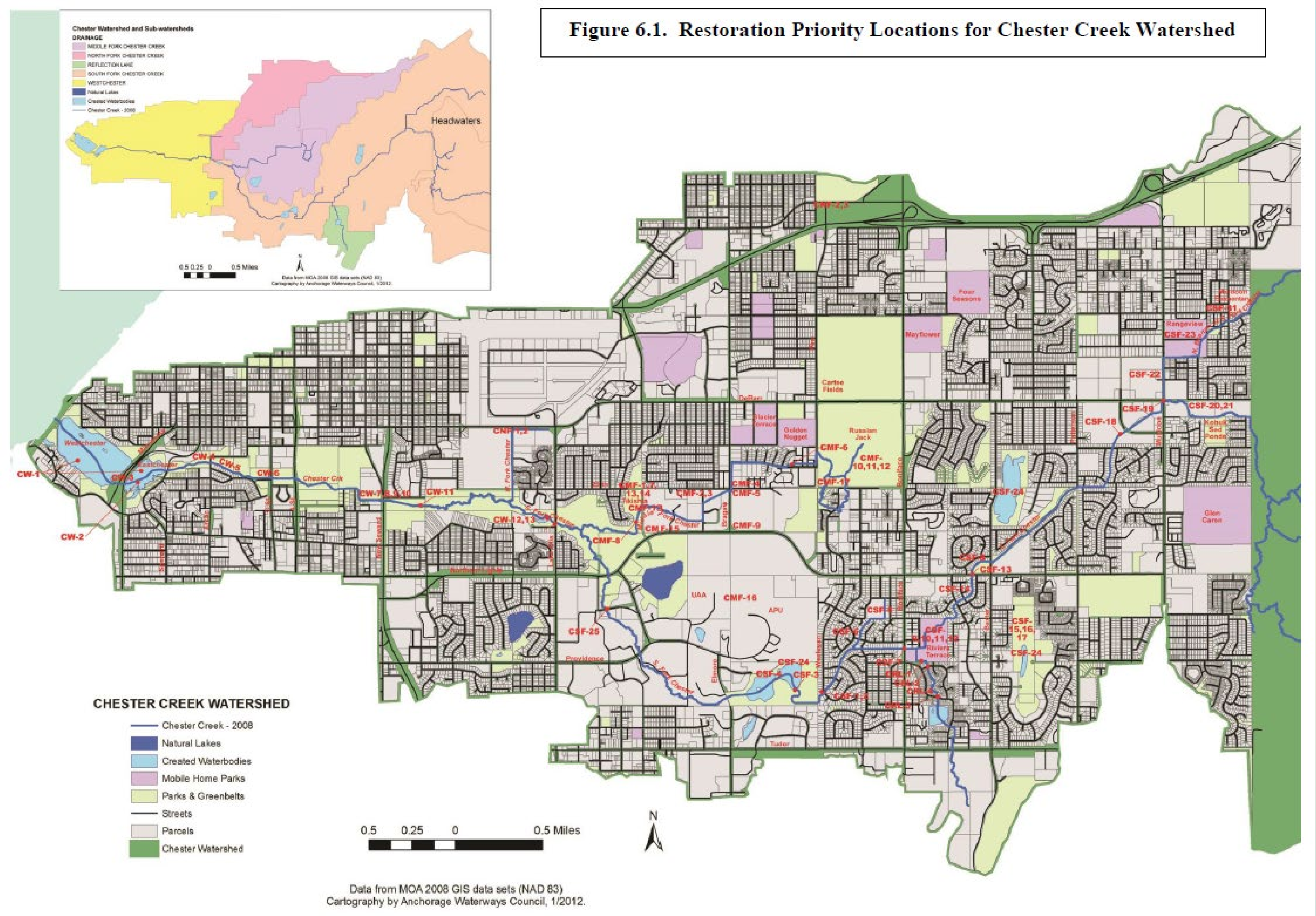
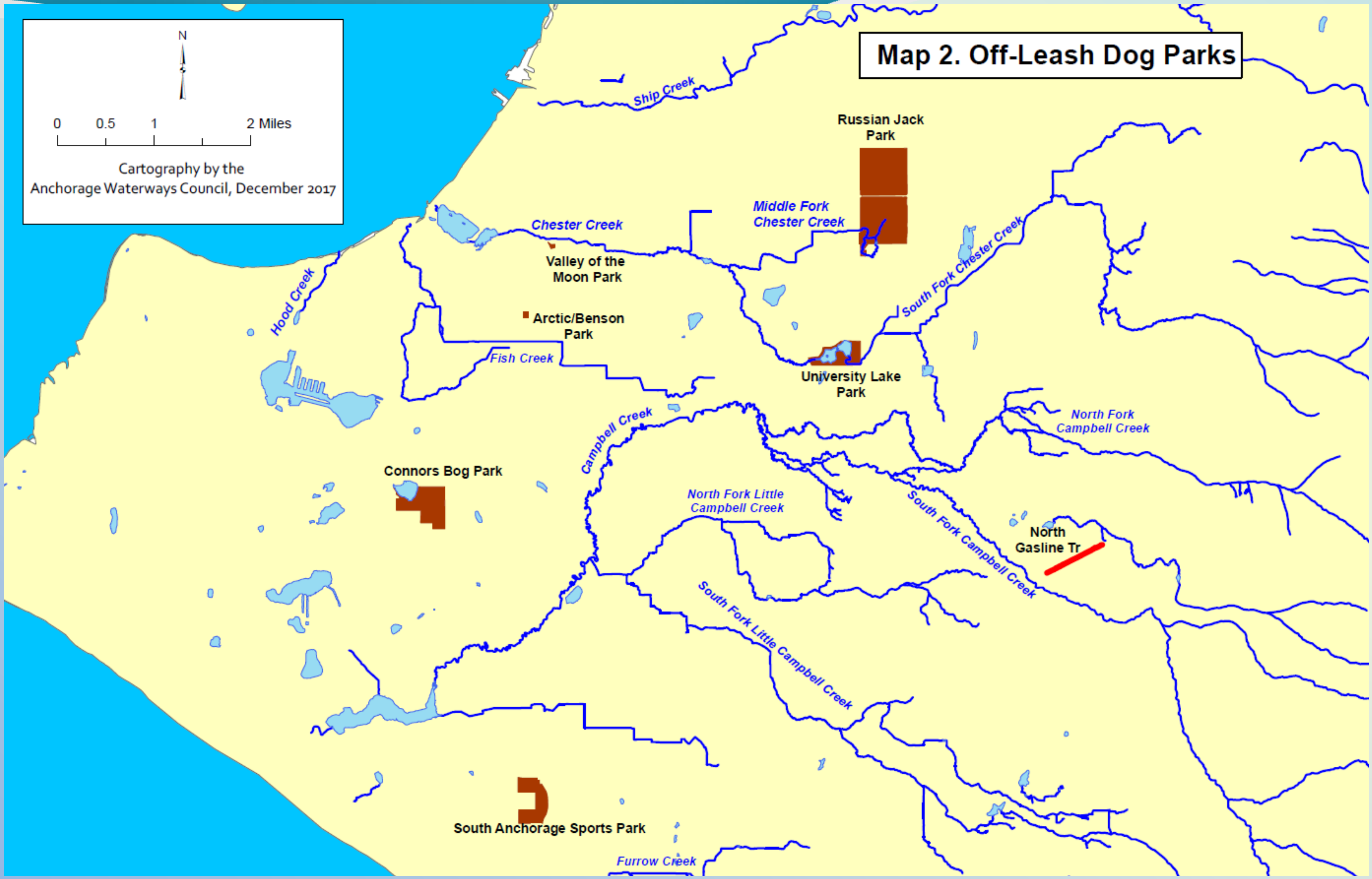


Chester Creek Restoration Priorities



Chester Creek Restoration Priorities

Dog Parks


Map 2. Off-Leash Dog Parks
N
0
0.5
1
2 Miles
Cartography by the
Anchorage Waterways Council, December 2017
Ship Creek
Russian Jack
Park
Middle Fork
Chester Creek
Chester Creek
Valley of the
Moon Park
Hood Creek
South Fork Chester Creek
Arctic/Benson
Park
Fish Creek
University Lake
Park
Campbell Creek
North Fork
Campbell Creek
Connors Bog Park
North Fork Little
Campbell Creek
South Fork Campbell Creek
North
Gasline Tr
South Fork Little Campbell Creek
South Anchorage Sports Park
Furrow Creek

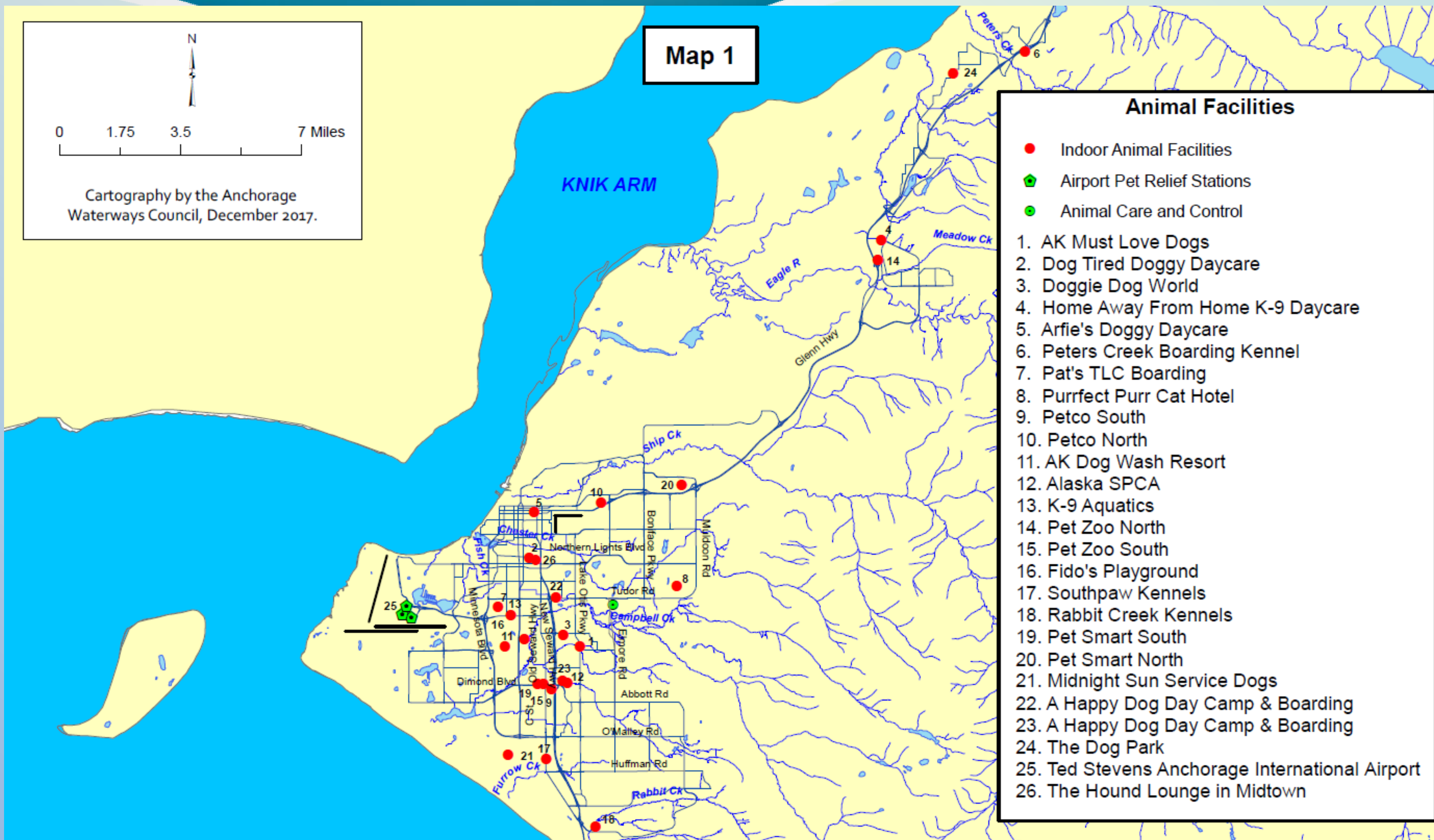
Dog Parks

You are Entering an
Off-Leash Dog Area
Regulations:
1. Dogs must be leashed upon entering and leaving the off-leash area.
2. Dogs must be legally licensed and have a current rabies vaccination.
3. Classified dogs and female dogs in heat are prohibited.
4. The owner or custodian of the dog must remain in the off-leash dog area with the dog.
5. Dogs must be under control as defined in AMC 17.05.010.
6. Dog feces must be cleaned up by the dog owner or custodian.
7. Holes dug by dogs must be filled by the dog owner or custodian.
8. Owners or custodians are responsible for all actions of their dogs.
AMC 17.10.090
Violations are Punishable by Fine

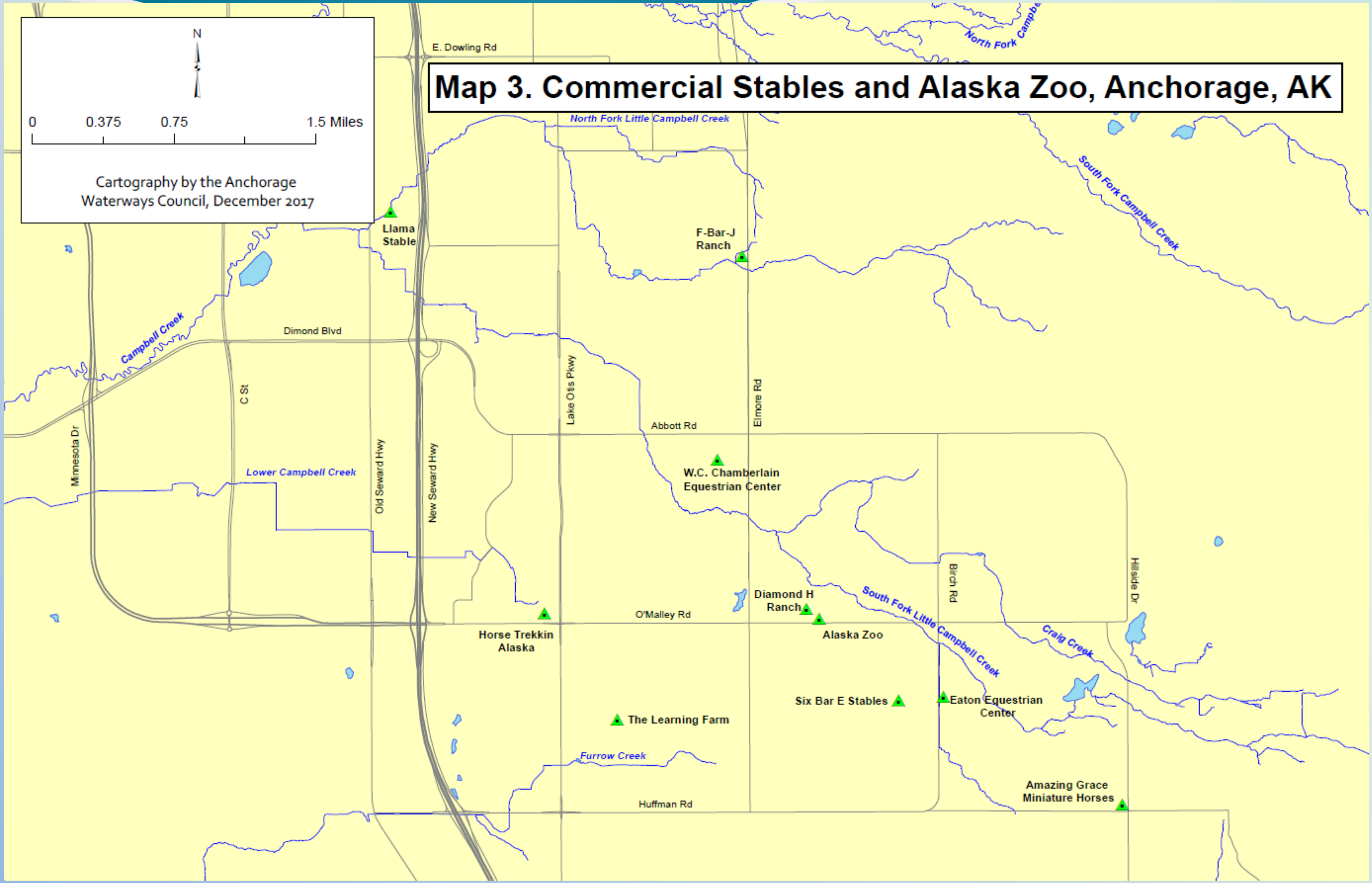
International
P
Multi-use/Ski-Joring Area
No off-leash dogs when trails are groomed
OFF-LEASH AREA
Year-round Off-Leash Exercise Area
Jewel Lake Road
Minnesota Dr
Multi-use/Ski-Joring Area
No off-leash dogs when trails are groomed
Connor's Bog Park
Anchorage Alaska

OFF-LEASH AREA
(Improvements anticipated summer 2016)
South Anchorage Sports Park
Anchorage Alaska

Animal Facilities



Commercial Stables and Alaska Zoo



Scoop the Poop!

Connors Bog on Scoop the Poop Day

University Lake on Scoop the Poop Day

Creek Cleanup

Fishing Line Recycling by AWC

Fishing line and trash collected from a monofilament bin near Ship Creek

Monofilament Recycling Bins in the Municipality

Fish Waste

Fish Waste Handling & Disposal

August 2016

Division of Environmental Health

Solid Waste Program

Anchorage Office:
555 Cordova St
Anchorage, AK 99501
(907)269-7802
Fax (907) 269-7510

Fairbanks Office:
610 University Ave
Fairbanks, AK 99709
(907) 451-2108
Fox (907) 451-2188

Juneau Office:
410 Willoughby Ave.
Suite 303
Juneau, AK 99801
(907) 465-5318
Fax (907) 465-5362

Improper disposal of fish waste from sport fishing, personal use fishing, and commercial fisheries poses a potential risk to the environment and public health and safety. The Alaska Department of Environmental Conservation (ADEC) Solid Waste Program only regulates the land disposal of fish waste from commercial operations. However, it is important to understand the best management practices for disposing fish waste to reduce nuisances and animal attraction.

Improper disposal of fish waste creates a dangerous bear attractant.

- **Chop the fish carcass up and throw it into fast-moving water;**
- **Take it directly to the landfill; or**
- **Put it in YOUR trash the morning of pickup.**

Personal Use & Sport Fish Waste

Even for sport and personal use fishing, disposing of fish waste on public or private land is illegal and can result in fines. The Alaska Department of Fish & Game recommends that you clean fish riverside or in port, chop fish carcasses into numerous pieces, and throw them into deep or fast-moving water or use a provided fish grinder. Anglers who remove fish from the fishing site and fillet or process them must also dispose of fish waste in a safe manner:

- Fish waste should be taken directly to a permitted landfill that will accept it.
  - The Central Peninsula Landfill in Soldotna accepts fish waste free of charge during the fishing season.
  - Anchorage Regional Landfill, the Central Transfer Station, and the Girdwood Transfer Station accept residential fish waste.
  - Matanuska-Susitna Borough takes bagged residential fish waste at the Palmer Central Landfill and the Big Lake, Butte, and Sutton transfer stations.
- If you have local trash pickup, freeze the fish waste to eliminate odors and then put it out of the morning of your trash pickup day. Do not place waste out the night before or put it in commercial dumpsters.

Commercial Fish Waste

ADEC Solid Waste Program allows three methods for managing commercial fish waste on land:

- Landfill Disposal: Commercial fish waste may be disposed in a permitted landfill willing to accept it.

Q & A Discussion

Anchorage MS4 Permit

2022 MOA Dry Weather Screening (DWS) Program

March 9th, 2023

Eagle River 1417-1

Fish Creek
684-1

Contents

DWS Program Objectives

- Dry Weather Screening (DWS) Program
- Detect and reduce illicit discharges to the Municipal Separate Storm Sewer System (MS4)
- Illicit discharge = any discharge not entirely composed of stormwater

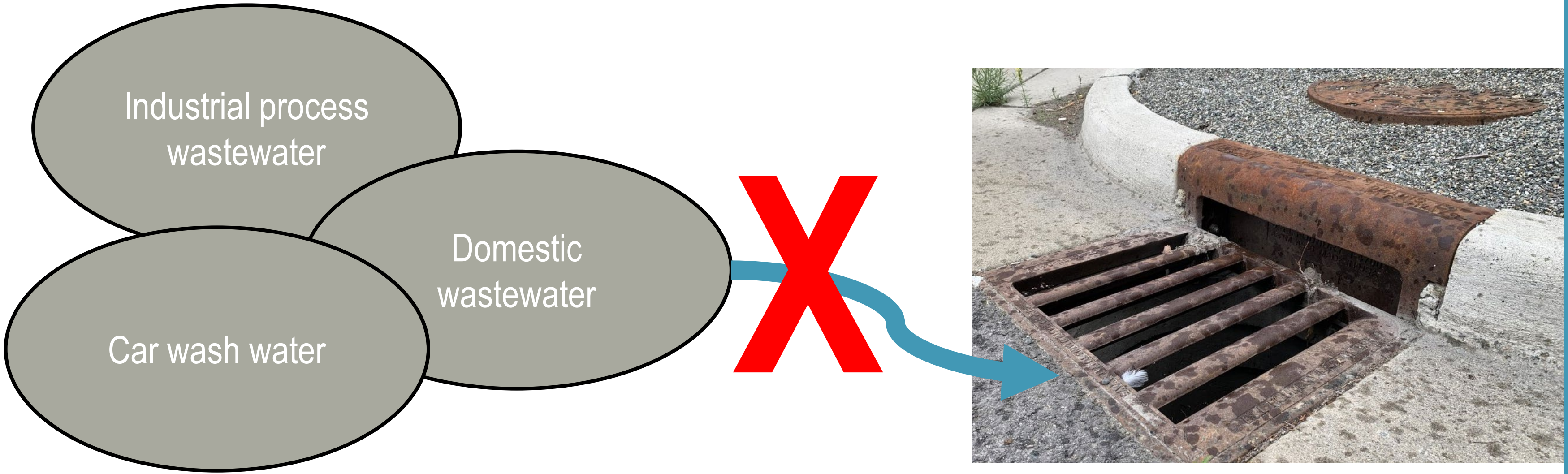
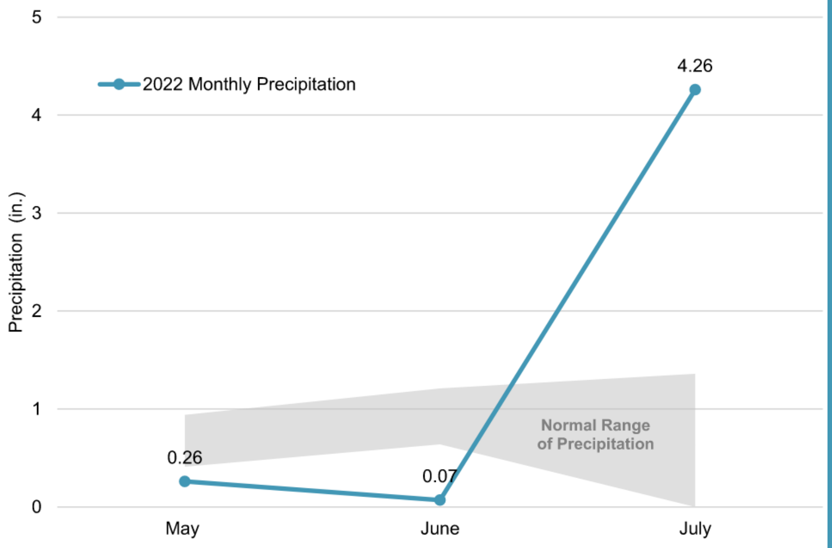


Image Credit: Alaska News Source

DWS Program Overview

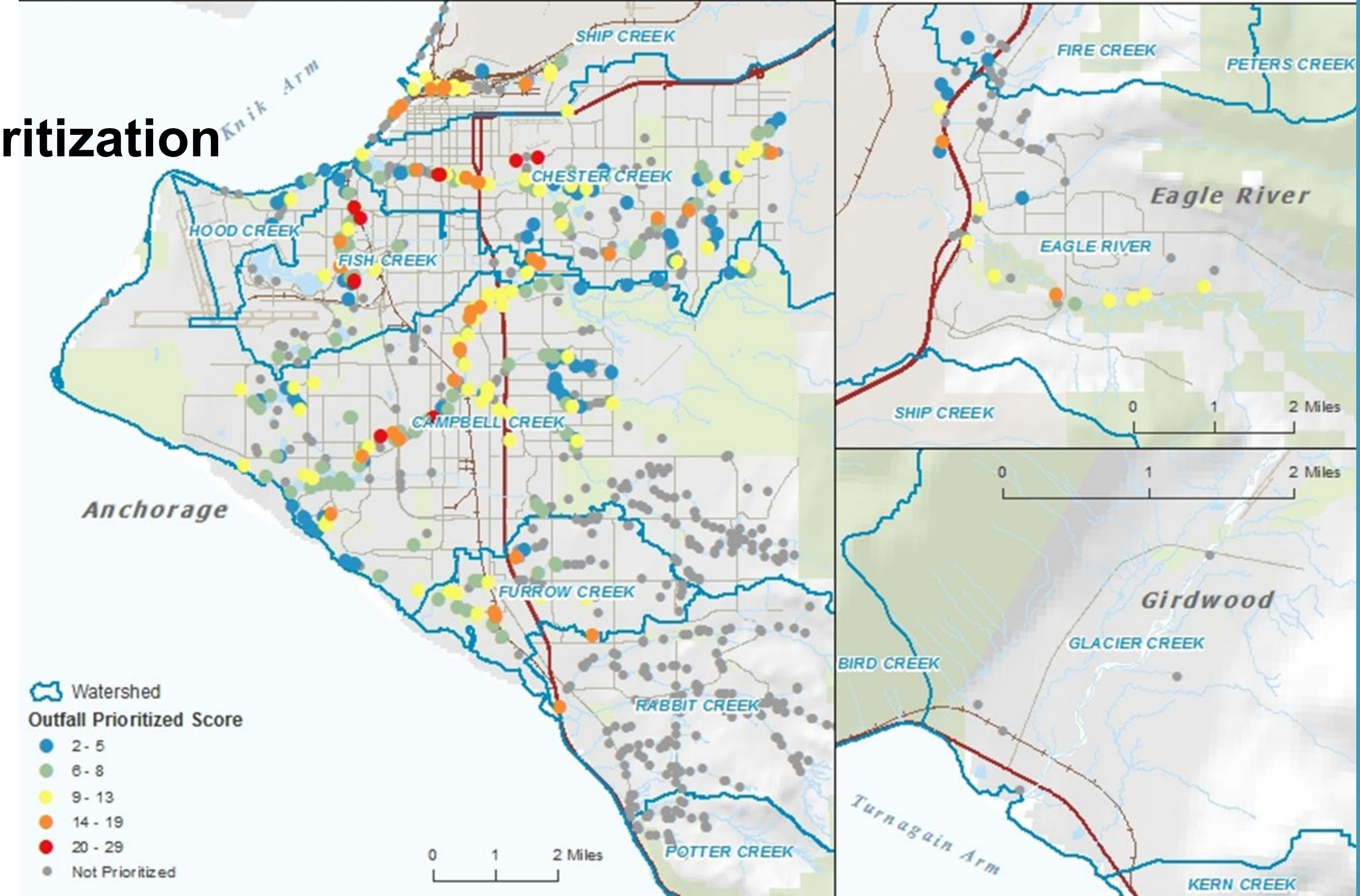
- Municipal Separate Storm Sewer System (MS4) permit
  - 2020 – 2025 cycle
- June – August
- Conducted after at least 48 hours of dry weather

1. Outfall evaluation and prioritization
2. Annual monitoring of 30 outfalls
3. Sampling of suspected illicit discharges



Fish Creek 79-353

Prioritization



Furrow Creek
292-192

DWS Monitoring

- Historical record of previous monitoring efforts
- Potential indicators of illicit discharge
  - Odors
  - Color
  - Clarity
  - Floatables
  - Deposits
  - Stains
  - Sheen
  - Surface scum
  - Debris

DWS Tested Parameters

Measurement Type	Parameter	Reporting Range	Threshold
Field	pH	0 – 14 STD	≤ 4 or ≥ 9 STD
	Total Chlorine	0.1 – 3.4 mg/L	≥ 1.0 mg/L
	Detergents	0.05 – 1.2 mg/L	≥ 1.0 mg/L
	Total Copper	0.1 – 4.0 mg/L	≥ 1.0 mg/L
	Total Phenols	0.1 – 5 mg/L	≥ 0.5 mg/L
	Turbidity	0.1 - 1,000 NTU	≥ 250 NTU
Laboratory	Fecal Coliform	1 colony/100 mL – too numerous to count	≥ 400 colonies/100 mL

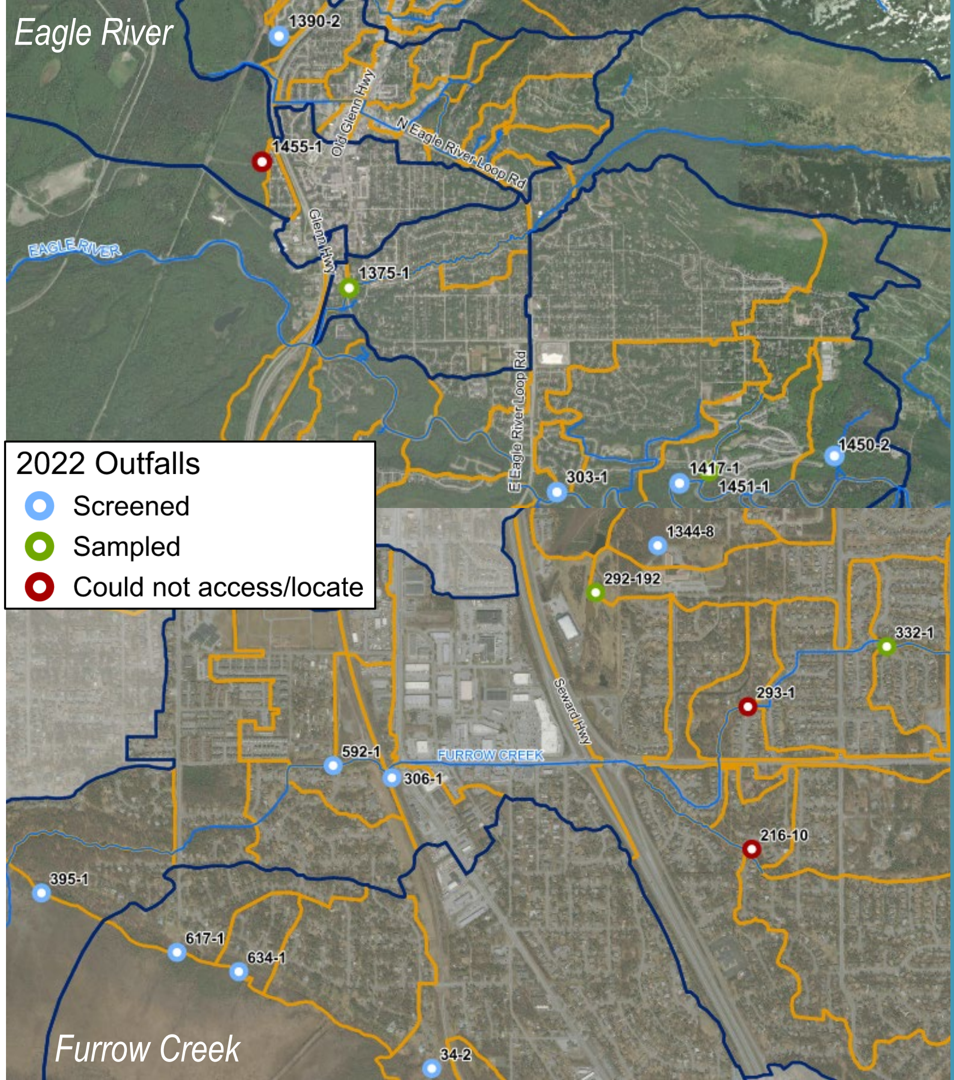
- 7 tested parameters
- Observe for maintenance issues

Eagle River 1375-1

2022 DWS Field Work

- Watersheds monitored:
    - Chester Creek
    - Eagle River
    - Fire Creek
    - Fish Creek
    - Furrow Creek
    - Rabbit Creek

- 30 Observed outfalls:
    - 16 flowing
        - 6 assumed to convey groundwater
    - 7 submerged or backwatered
    - 2 suggested maintenance
    - 10 unable to access or locate
    - 4 sampled for illicit discharge



Results

Eagle River

Left: 1375-1

Right: 1451-1

Watershed	Outfall ID	Date	Flow	pH	Total Chlorine (mg/L)	Detergents (mg/L)	Total Copper (mg/L)	Total Phenols (mg/L)	Turbidity (NTU)	Fecal Coliform (colonies/100mL)
Eagle River	1375-1	6/16/2022	Medium	8.4	<0.1 (ND)	<0.05 (ND)	<0.1 (ND)	<0.1 (ND)	0.63	1.7
Eagle River	1451-1	6/16/2022	Medium	7.8	<0.1 (ND)	<0.05 (ND)	<0.1 (ND)	<0.1 (ND)	1.49	1.7

Notes: mg/L = milligram per liter; NTU = nephelometric turbidity; ND = not detect

Results

Furrow Creek

Left: 292-192

Right: 332-1

Watershed	Outfall ID	Date	Flow	pH	Total Chlorine (mg/L)	Detergents (mg/L)	Total Copper (mg/L)	Total Phenols (mg/L)	Turbidity (NTU)	Fecal Coliform (colonies/100mL)
Furrow Creek	292-192	6/17/2022	Medium	8.3	<0.1 (ND)	<0.05 (ND)	<0.1 (ND)	<0.1 (ND)	6.48	6.7
Furrow Creek	332-1	6/17/2022	Very Low	8.5	<0.1 (ND)	<0.05 (ND)	<0.1 (ND)	<0.1 (ND)	12.5	1.7

Notes: mg/L = milligram per liter; NTU = nephelometric turbidity; ND = not detect

2022 DWS Results Summary

- 30 outfalls monitored
- 4 outfalls sampled
- No exceedances

Fish Creek 1278-1

Fish Creek 1003-1

Thank you

Questions?

2022 MOA Pesticide Screening Program

March 9th, 2023

01 Pesticide Screening Overview

02 2022 Pesticide Screening Results

03 2022 Pesticide Screening Program Conclusions

Little Campbell Lake

01 PESTICIDE SCREENING OVERVIEW

Objectives of Pesticide Monitoring Program

- Meet the requirements of the Municipal Separate Storm Sewer System (MS4) permit (2020 – 2025) for 2022 and 2024
- Determine presence of pesticides in three Anchorage closed lakes
- Testing for 2,4-D and Carbaryl as representative pesticides

Pesticide Screening History:

- Redesign 2011 Permit to increase monitoring
- 2013 – detectable levels of 2,4-D in Hideway Lake and Lake Otis – education program

Little Campbell Lake

Pesticide Monitoring Sites

- Three Closed Lake Basins
  - Lake Otis
  - Hideaway Lake
  - Little Campbell Lake (control)
- Sample locations coincide with those from previous permits: 2011, 2013, 2016, and 2018

Pesticide Monitoring Methodology

- Rain event followed by 48 hours of dry weather
- Sampling takes place from a small boat located above the deepest part of each lake
- Sampling occurs at 1 m below the surface
  - YSI: pH, temp (C°),
  - Discrete Depth Sampler: 2, 4-D and Carabryl
- 2, 4-D and Carabryl analyzed at laboratory
- Field replicate verification

Lake Otis

Pesticide Screening Parameters and Methods of Analysis

Parameter	Method	Analysis Location	Range
Temperature	SM 2550 B YSI Handheld Probe	Field	-5 °C – 45 °C
pH	EPA 150.2 YSI Handheld Probe	Field	0 – 14 STD
2,4-D	EPA 515.4	Laboratory	NA
Carbaryl	EPA 531.2	Laboratory	NA

Lake Otis

02 2022 PESTICIDE SCREENING OVERVIEW

2022 Pesticide Screening Results

- No detection of tested pesticides
- Sample locations consistent with previous events

Site	Collection Time	Temp (°C)	pH	2,4-D	Carbaryl (ug/L)/MDL
Little Campbell Lake	9:45	15.1	5.7	ND(0.055)	ND(0.045)
Hideaway Lake	11:25	13.7	7.67	ND(0.055)	ND(0.045)
Lake Otis	12:10	15.9	6.36	ND(0.055)	ND(0.045)
Lake Otis (Duplicate)	12:20	15.9	6.36	ND(0.055)	ND(0.045)

Hideaway Lake

03 2022 PESTICIDE MONITORING CONCLUSIONS

2022 Pesticide Monitoring Conclusions and Looking Ahead

- No detection of tested pesticides
- May be attributed to education and outreach on pesticide impacts on waterbodies
- Continued educational program
- Permit cycle includes 2024 sampling event

Little Campbell Lake

Thank you

Questions?

2022 MOA Stormwater Outfall Monitoring Program

March 9th, 2023

01 Stormwater Monitoring Program Overview

02 2022 SWM Program Results Overview

03 2022 SWM Program Conclusions

Lynwood Rain Gauge

01 STORMWATER MONITORING PROGRAM OVERVIEW

Objectives of Stormwater Monitoring (SWM) Program

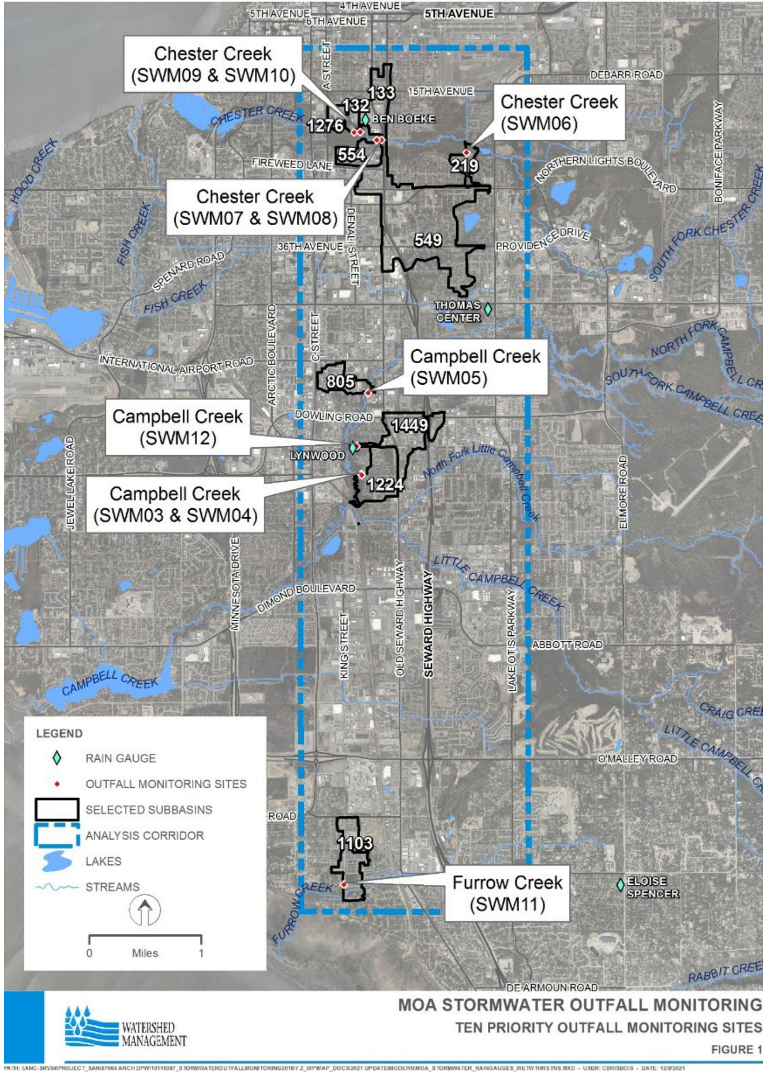
- Meet the requirements of the Municipal Separate Storm Sewer System (MS4) permit (2020 – 2025)
- Estimate annual pollutant loading

Used to:

- Assess the effectiveness of existing stormwater controls
- Prioritize portions of the MS4 that need additional controls
- Measure whether Total Maximum Daily Load (TMDL) objectives are met

SWM Monitoring Corridor

- Ten priority outfall sites
- Outfalls geographically distributed
- Represent variety of Subbasin land-use types
  - Industrial
  - Mixed
  - Residential
- Outfalls discharge to Campbell, Chester, and Furrow Creek Watersheds



SWM Program Methodology

- Stormwater outfall sampled after >0.1 inch of precipitation in 24 hours preceded by 24 hours of ≤0.1 inch of precipitation
- Outfall discharge calculated from flow velocity and outfall geometry
- Water quality parameters assessed through qualitative observations, field measurements, and laboratory testing

SWM11

SWM Tested Parameters

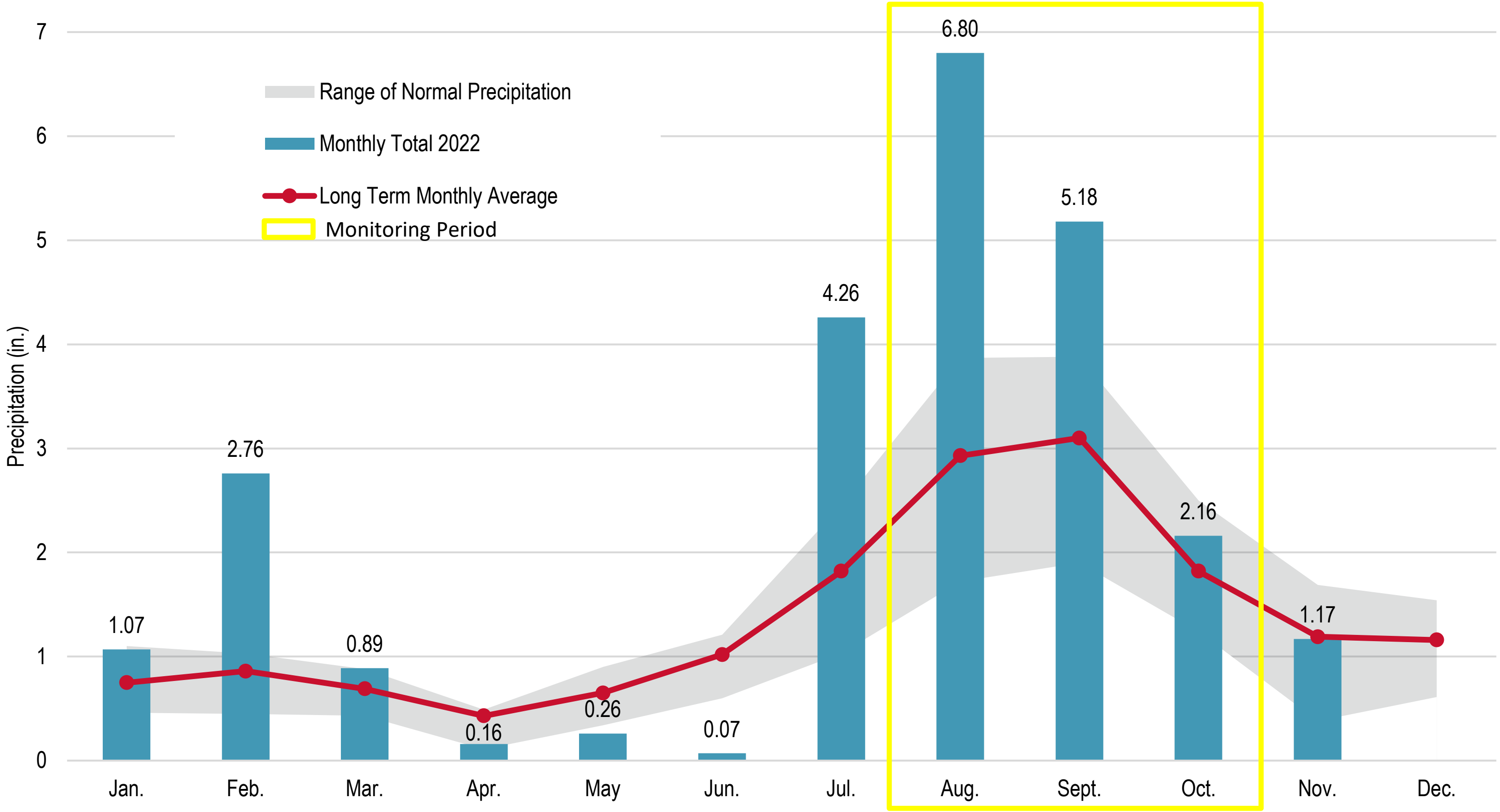
Field Measurements and Observations

Parameter	Purpose
Flow	Characterize flow & loading
Specific Conductivity	Stormwater quality
Dissolved Oxygen (DO)	Stormwater quality
pH	Stormwater quality
Temperature	Stormwater quality
Turbidity	Stormwater quality
Odor	Qualitative Observation
Color	Qualitative Observation
Clarity	Qualitative Observation
Floatables	Qualitative Observation
Deposits or Stains	Qualitative Observation
Sheen	Qualitative Observation
Surface Scum	Qualitative Observation
Debris	Qualitative Observation

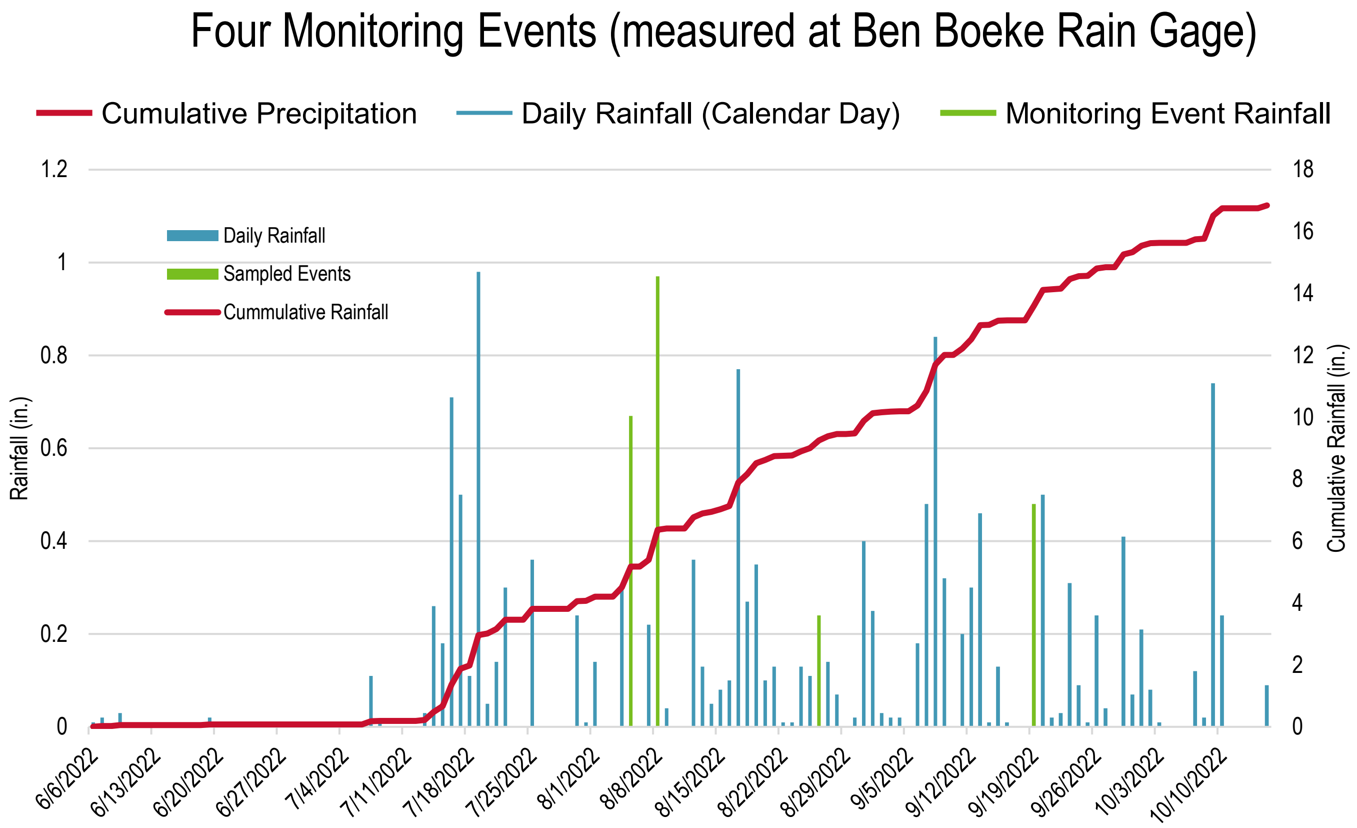
Laboratory Measurements

Parameter	Purpose
5-Day Biochemical Oxygen Demand (BOD_5)	Stormwater quality
Fecal Coliform	Stormwater quality & loading
Total Suspended Solids (TSS)	Stormwater quality
Total Aromatic Hydrocarbons (TAH)	Stormwater quality & loading
Total Aqueous Hydrocarbons (TAqH)	Stormwater quality & loading
Dissolved Copper	Stormwater quality
Total Hardness	Stormwater quality

2022 Precipitation vs. Historical Averages



2022 Monitoring Events

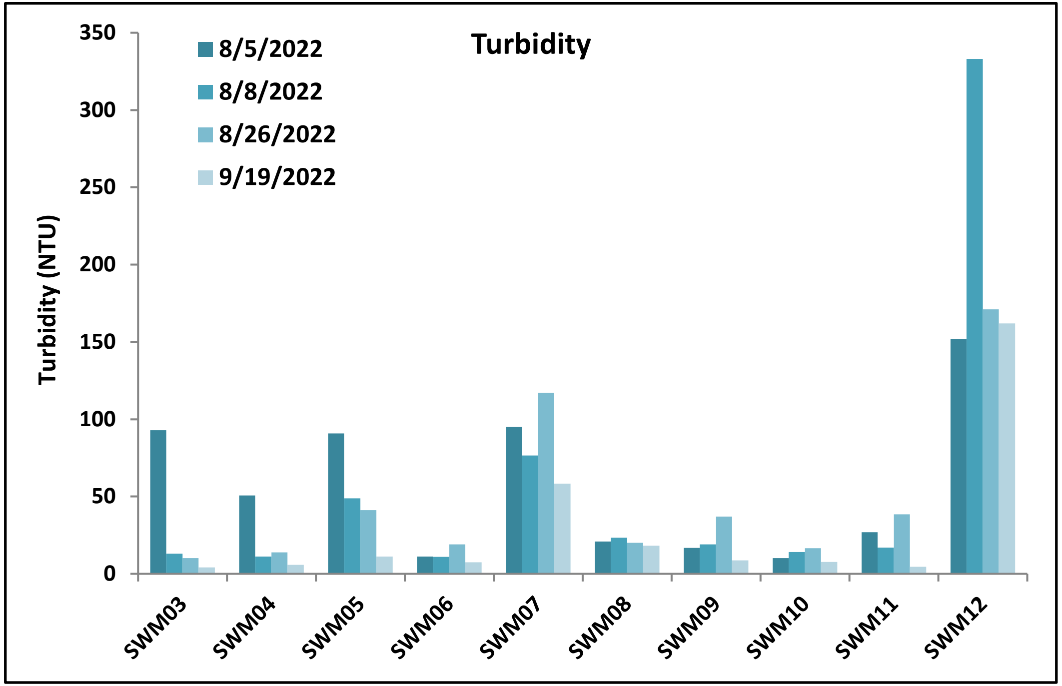


SWM08

02 2021 SWM PROGRAM RESULTS OVERVIEW

2022 SWM Program Field Measurements

- Flow Rate
- Turbidity
- Dissolved Oxygen (DO)
- Total Dissolved Solids
- pH
- Temperature



TAKEAWAY –

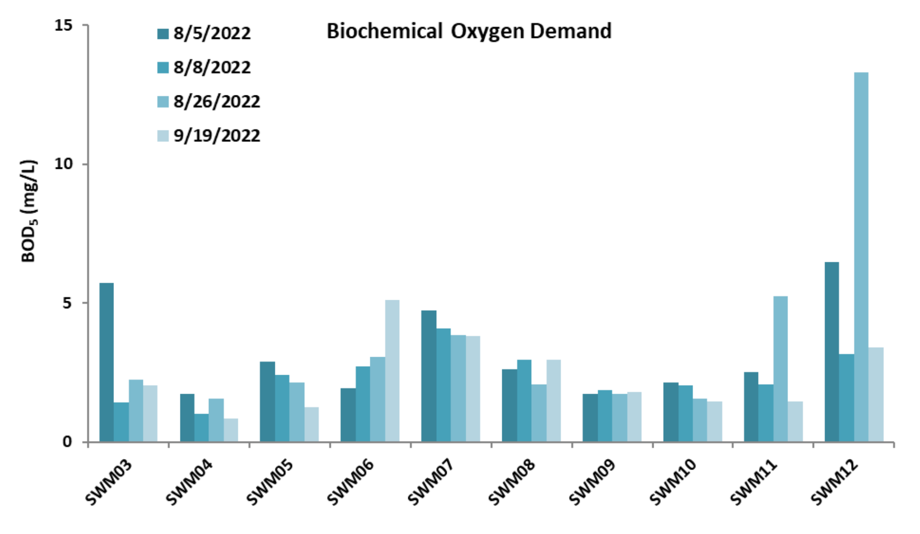
- **Consistent temperatures**
- **High Turbidity at SWM 12**
- **Low pH at SWM07**
- **Other field measurements within historical ranges**

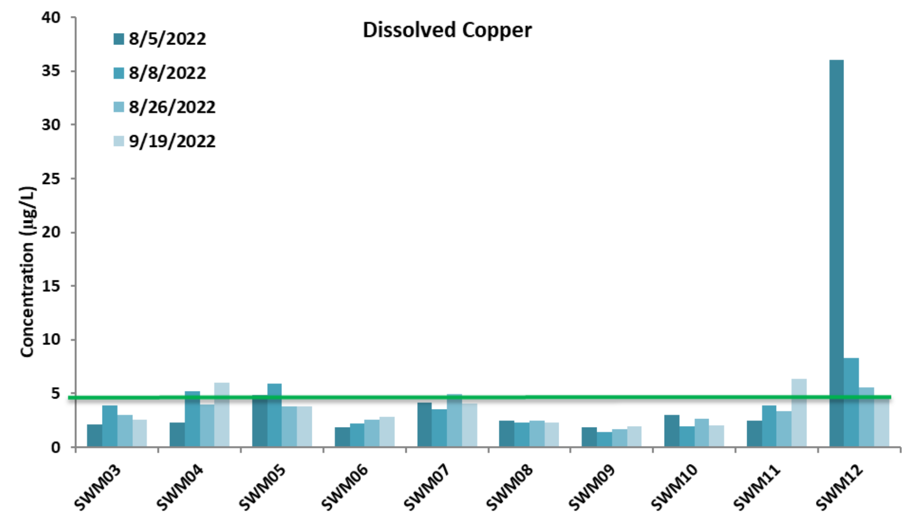
2022 SWM Program Laboratory Measurements

- Biochemical oxygen demand (BOD_5)
- Total Suspended Solids (TSS)
- Fecal Coliform
- Hardness
- Dissolved Copper
- Hydrocarbons (TAH and TAqH)

TAKEAWAY

- **BOD_5 – Lower than 2021**
- **TSS – isolated spikes**
- **Copper and Hardness within historical ranges**

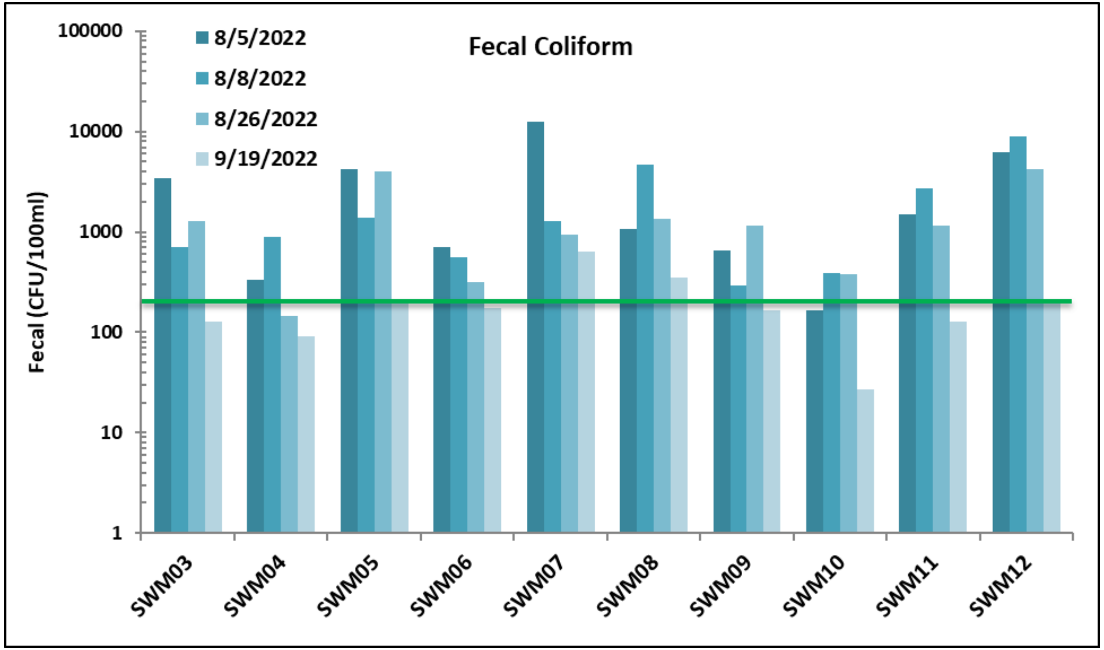




2022 SWM Program Fecal Measurements

- Fecal levels generally normal when compared to data record

TAKEAWAY – within historical range

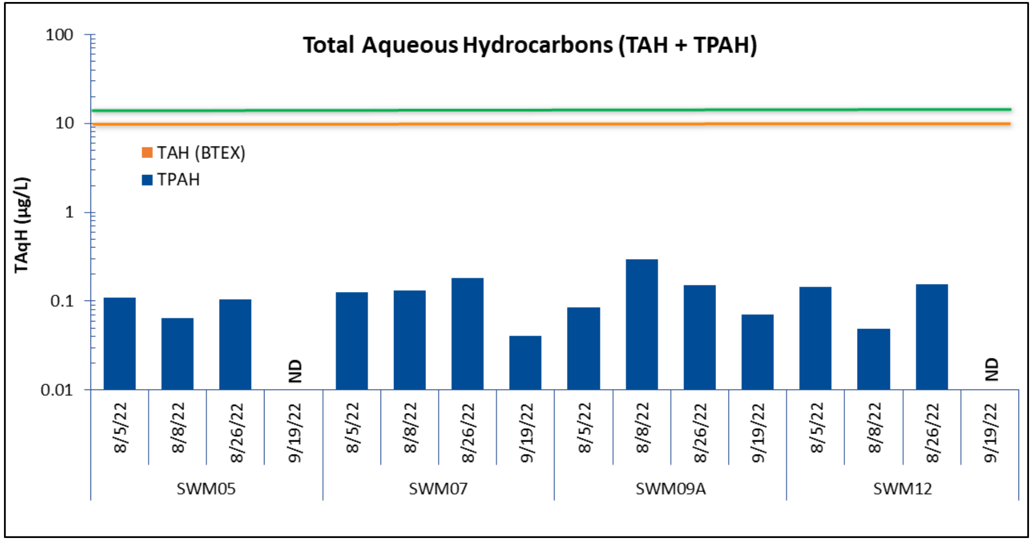


= *indicates upper AWQS fecal coliform limit of 200 CFU/100 mL*

2021 SWM Program Hydrocarbon Measurements

- All samples below AWQS limits for TAH and TAqH
- Many results are estimated low by lab

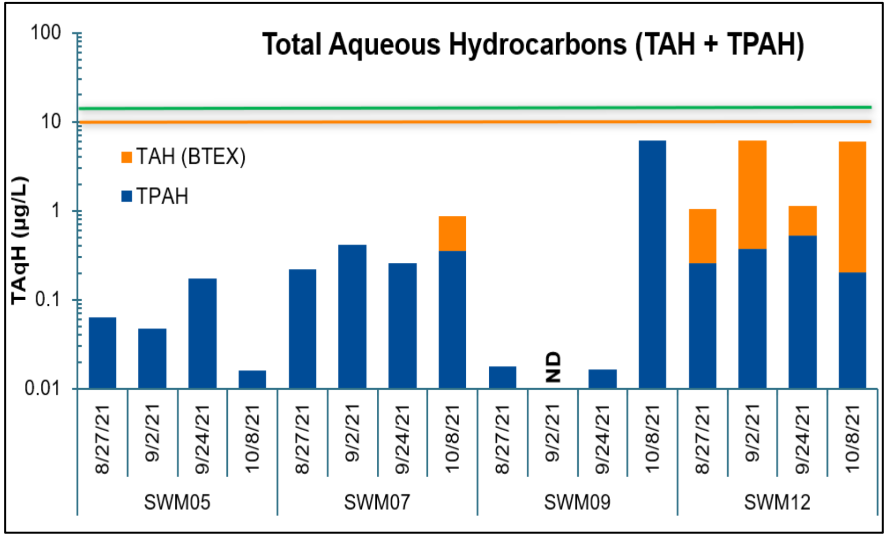
TAKEAWAY – Lower concentrations of TAqH and no detections of BTEX in 2022



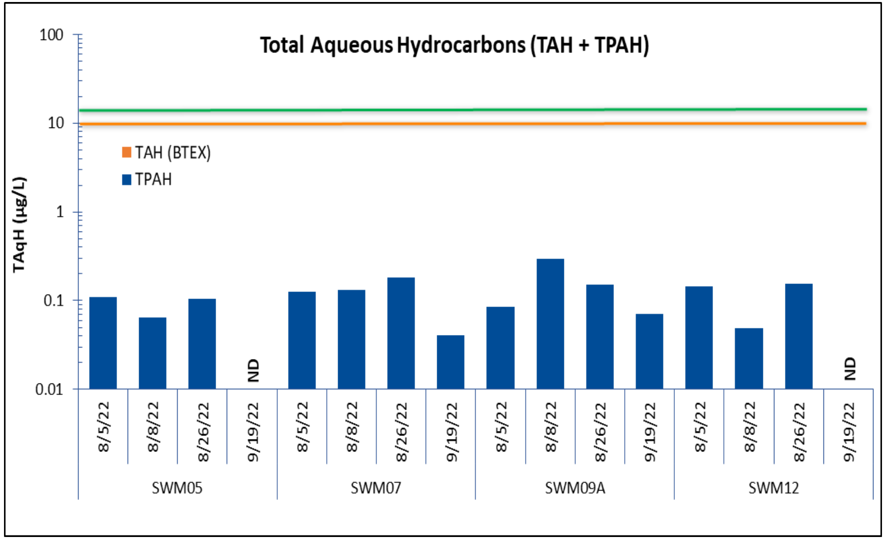
= *indicates the upper AWQS TAH limit of 10 µg//L*
= *indicates the upper AWQS TAqH limit of 15 µg/L*

Comparison of Hydrocarbons

2021 Hydrocarbons



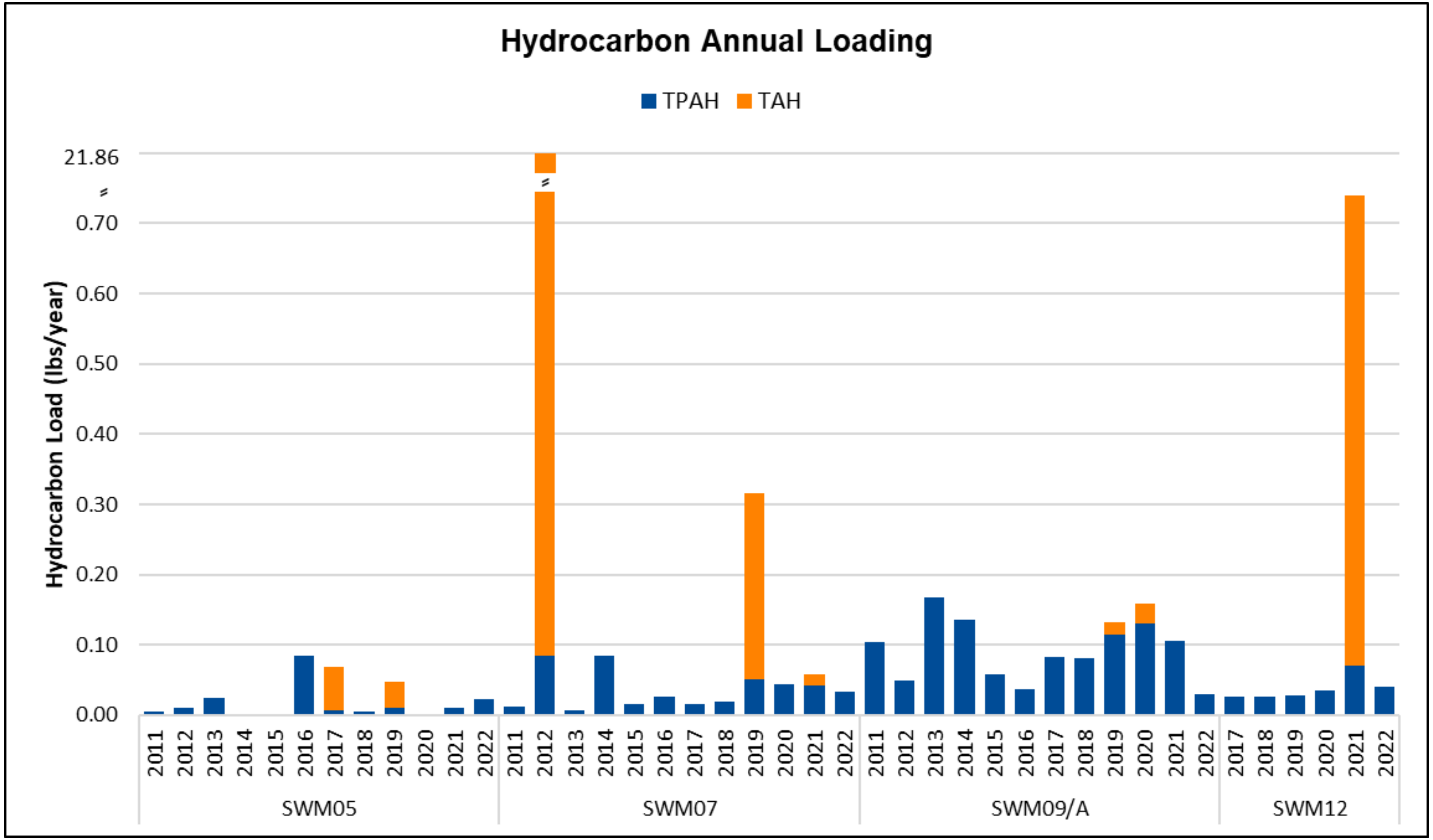
2022 Hydrocarbons



= *indicates the upper AWQS TAH limit of 10 µg//L*

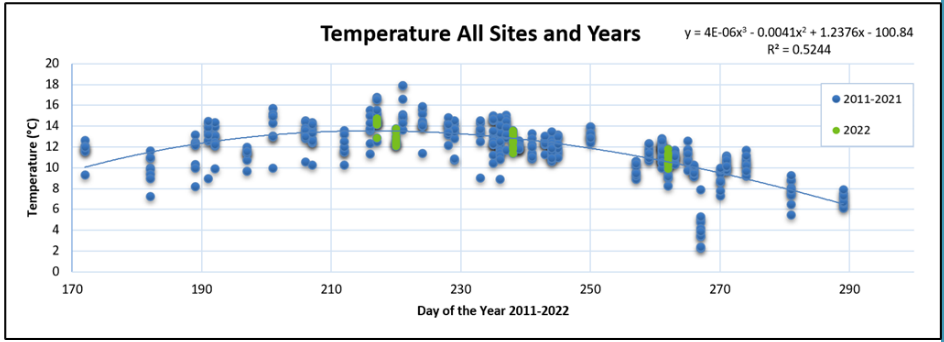
= *indicates the upper AWQS TAqH limit of 15 µg/L*

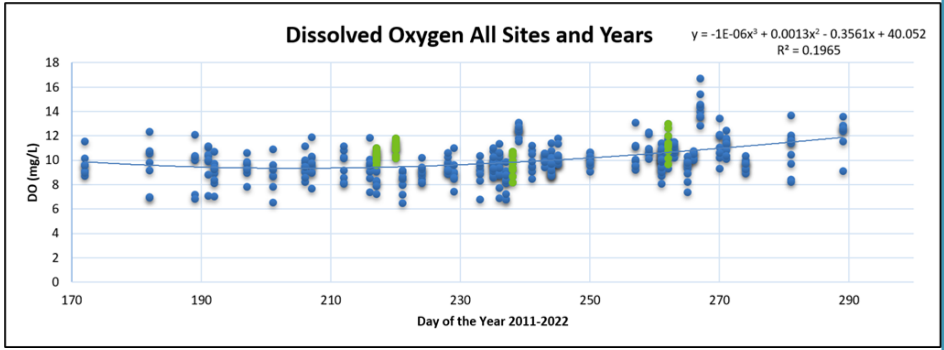
Hydrocarbon Annual Loading

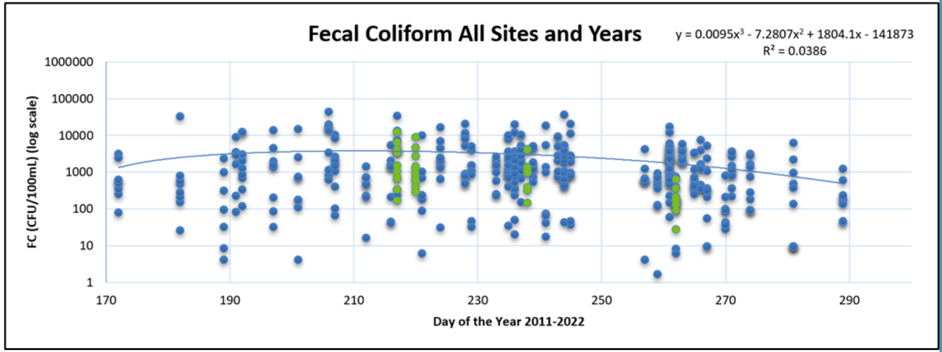


Seasonal & Multi-Year Trends

- Available data remains limited.
- Some seasonal affects observed in temperature-dependent parameters
- Studies show 20-years of data needed to establish statistical power







● = *2022 Results*
● = *2011 – 2021 Results*

SWM12

03

2022 SWM PROGRAM CONCLUSIONS

2022 SWM Program Conclusions

- Early to mid rain season sampling
- Samples generally fell within historical ranges for the program
- Storm events were long duration and with varying intensity
- Hydrocarbon detection decreased

SWM Program: Looking Ahead

- Investigating intensity of storms and affects on results
- Continued monitoring of hydrocarbons to determine if part of a broader trend
- Determining if any changes occur to changes in the MS4 infrastructure at SWM09A

SWM10

Thank you

Questions?

ANCHORAGE WATERWAYS COUNCIL

2022 Stormwater Education

Anchorage Waterways Council

Cherie Northon, Ph.D.

March 9, 2023

Public education and outreach on stormwater are accomplished through a variety of avenues:

- Rack cards
- Tabling opportunities--Potter Marsh Day, Dog Jog, etc.
- Events—Scoop the Poop Day
- E-newsletters
- Lectures/presentations and classes
- Publications
- TV/radio/news media
- Social media--Facebook

How to Live With a Lake

The Municipality of Anchorage is about 2,000 sq. mi. and has over 170 ponds and lakes. These waterbodies are some of Anchorage's premier amenities. Housing and other developments are adjacent to nearly half of them. This handout provides information on good practices for those who live near or recreate on lakes.

- Be a steward for your lake and keep an eye on it. Report any issues or concerns on our "Citizen's Reporting" form at anchoragecreeks.org
- If you are on a septic system, make sure it is properly and regularly maintained, keep it up to code, and ensure that harmful items don't enter it.
- With lakes most often downhill of a surrounding land surface, they become a perfect catchment for a variety of pollutants including yard chemicals, ice melt products, trash, litter, and pet waste runoff. Reduce or eliminate chemicals and make sure trash and pet waste are cleaned up. If you must apply yard or ice melt chemicals, read and follow directions and warnings.
- Dispose of vehicle fluids, old paint, and excess household and yard chemicals properly. The Municipal Solid Waste Services (SWS) has several options for recycling paints and collecting hazardous products. See muni.org/departments/sws/pages/default.aspx
- If possible, wash your vehicle at a car wash (where water is often recycled and conveyed to the sanitary sewer--not the storm drain system). When washing a vehicle at home, use phosphate-free soap, a hose with a nozzle that can be turned off, work on a level area of grass or gravel, and keep washwater from storm drains which convey it untreated into our creeks and lakes.

Be a SUPER hero, SCOOP up after your pets.

Runoff carries dog waste untreated into our community's creeks and lakes.

Bag it!

Take it!

Dispose of it in the trash!

Do your part to keep our waterways clean and healthy.

SCOOP THE POOP Anchorage, AK

anchoragecreeks.org

How to Live With a Creek

The Municipality of Anchorage is about 2,000 mi^2 and has approximately 2,250 miles of creeks and rivers. These waterways are often listed as some of Anchorage's premier amenities. This handout endeavors to provide information on how to be a good neighbor to our creeks.

- **Be a steward for your local creek and keep an eye on it.** Report any issues online at anchoragecreeks.org and clean up any trash.
- **Don't alter the course of a creek.** Creeks have a mind of their own about where they want to go, which is protected by local, state, and federal law.
- **Stormwater and yard runoff, cigarette butts, pet waste, other pollutants and debris run directly into storm drains which lead to our creeks--NOT to the sewage plant.**
- **Don't water your driveway and paved areas, and don't overwater your yard.** Your yard only needs about 1" of water. Put an empty tuna can on the area you are watering, and when it is full--you have about 1" of water.
- **Sweep your driveway rather than power washing or hosing it.**
- **Direct your downspouts onto your yard and off of impermeable surfaces. Also consider rain barrels and rain gardens to reduce yard runoff.**
- **Use automatic car washes as their waste water is usually recycled and is directed into the sewage system--not our creeks.** If you wash at home, park your vehicle on grass or gravel, and use non-phosphate soap.
- **Ensure that storm drains and culverts are not clogged.** Obstructed culverts and storm drains can cause flooding and block fish passage.
- **Keep dogs and horses out of creeks and off of creek banks ESPECIALLY when salmon are spawning.** Bank trampling causes erosion and sediment to run off into waterways, which disturbs gravel beds where fish spawn and little ones grow.
- **Clean up pet waste because the fecal coliform bacteria found in it runs off into our creeks.** All the creeks in Anchorage (except Rabbit and Little Rabbit) are considered "impaired waters" due to fecal coliform contamination. Do your part to reduce this problem. SCOOP-the-POOP!

Scoop the Poop Day - 2018

Remember, ONLY clean water down the drain!

Thank you!

cherie@anchoragecreeks.org

CHESTER CREEK WATERSHED STORMWATER MASTER PLAN

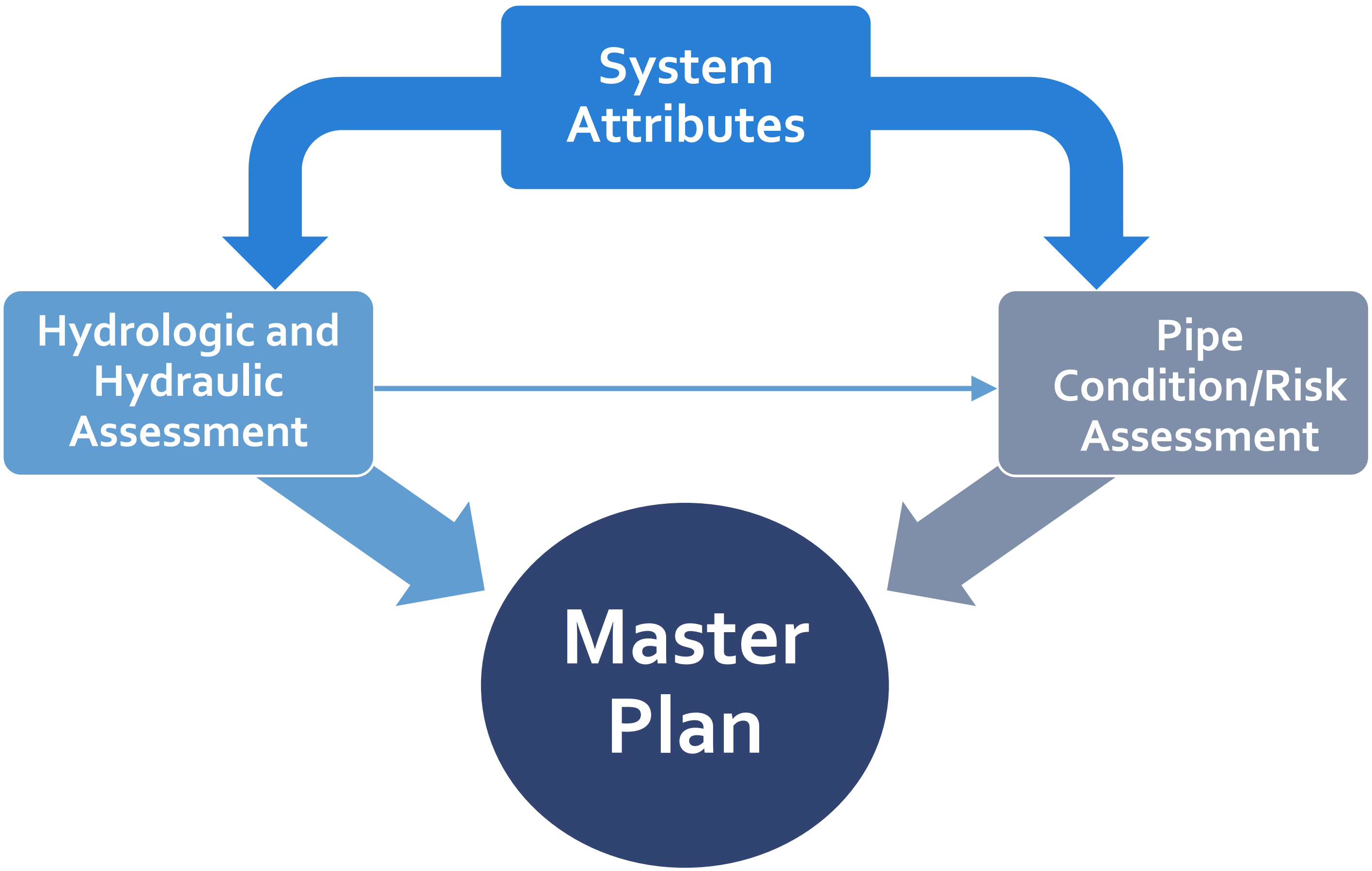
Presented for: 2023 Watershed Update for the MOA

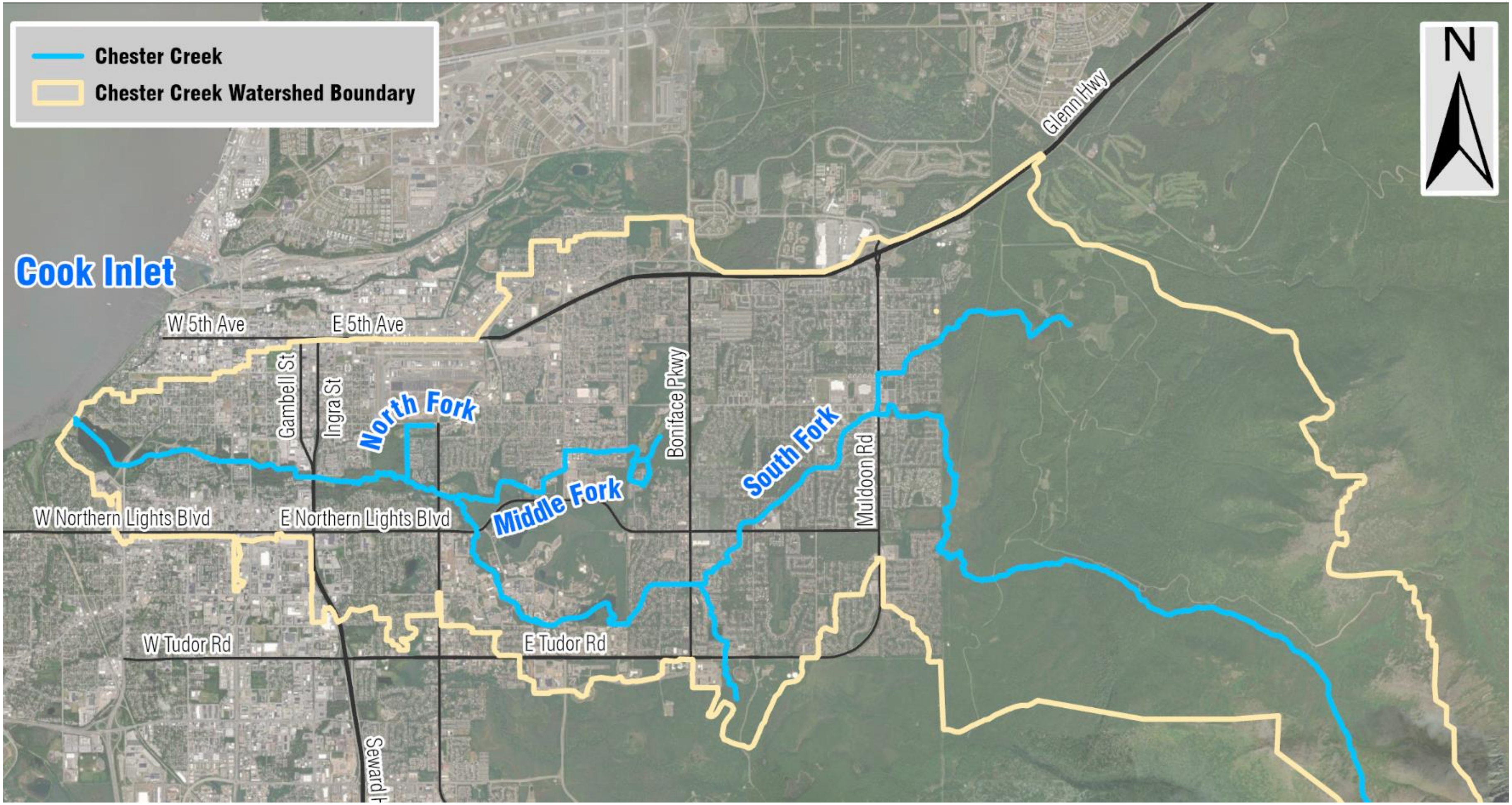
Presented by: AWR Engineering, LLC

PURPOSE AND NEED

Performance	Risk	Planning
Pipe capacity	Failure potential	Pipe replacements
Surcharging	Failure consequence	Pipe upgrades
Surface flooding	Total Risk	Area development
Variation		System loading

MASTER PLAN COMPONENTS

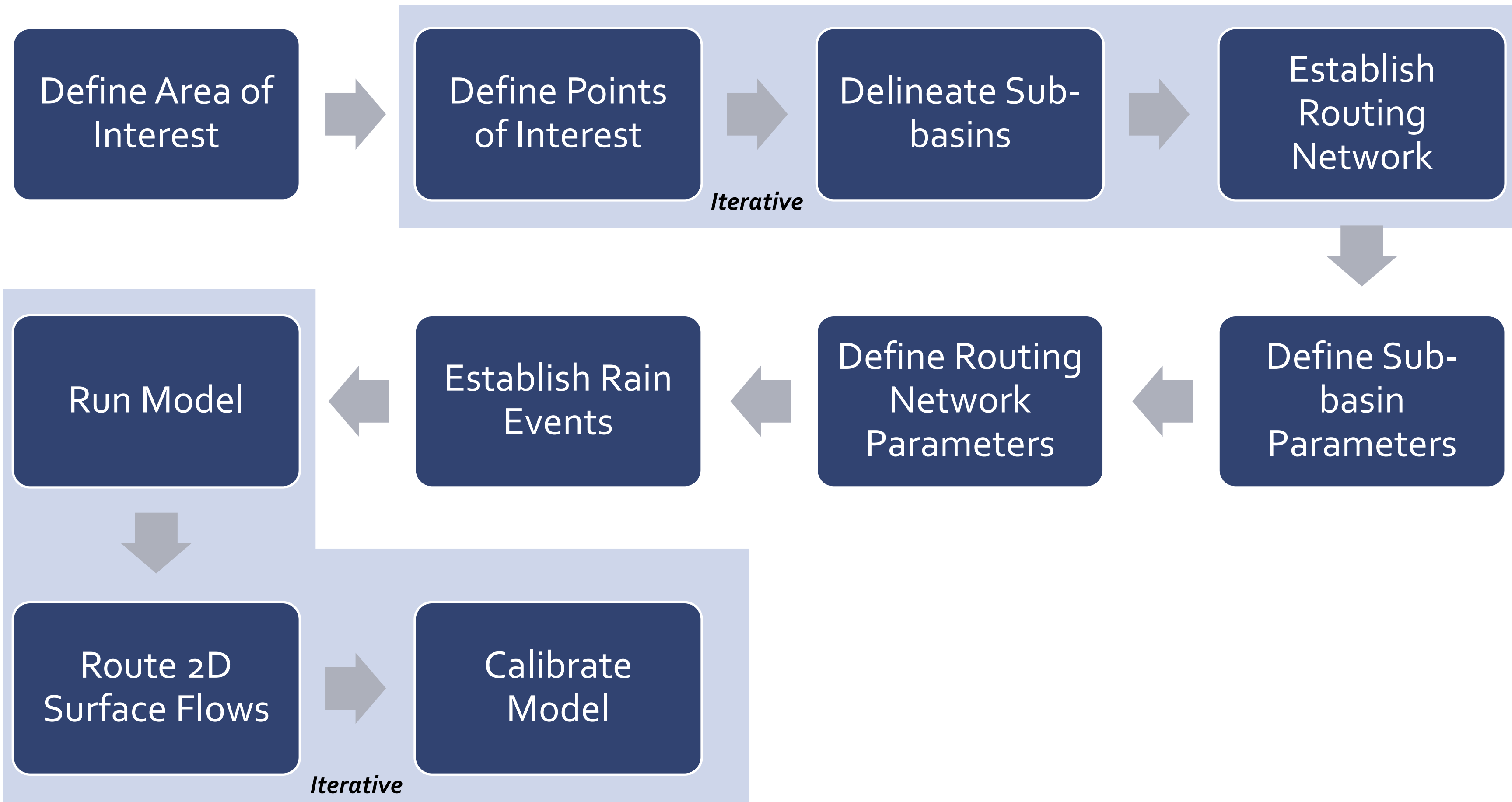




HYDROLOGIC & HYDRAULIC ASSESSMENT

Watershed

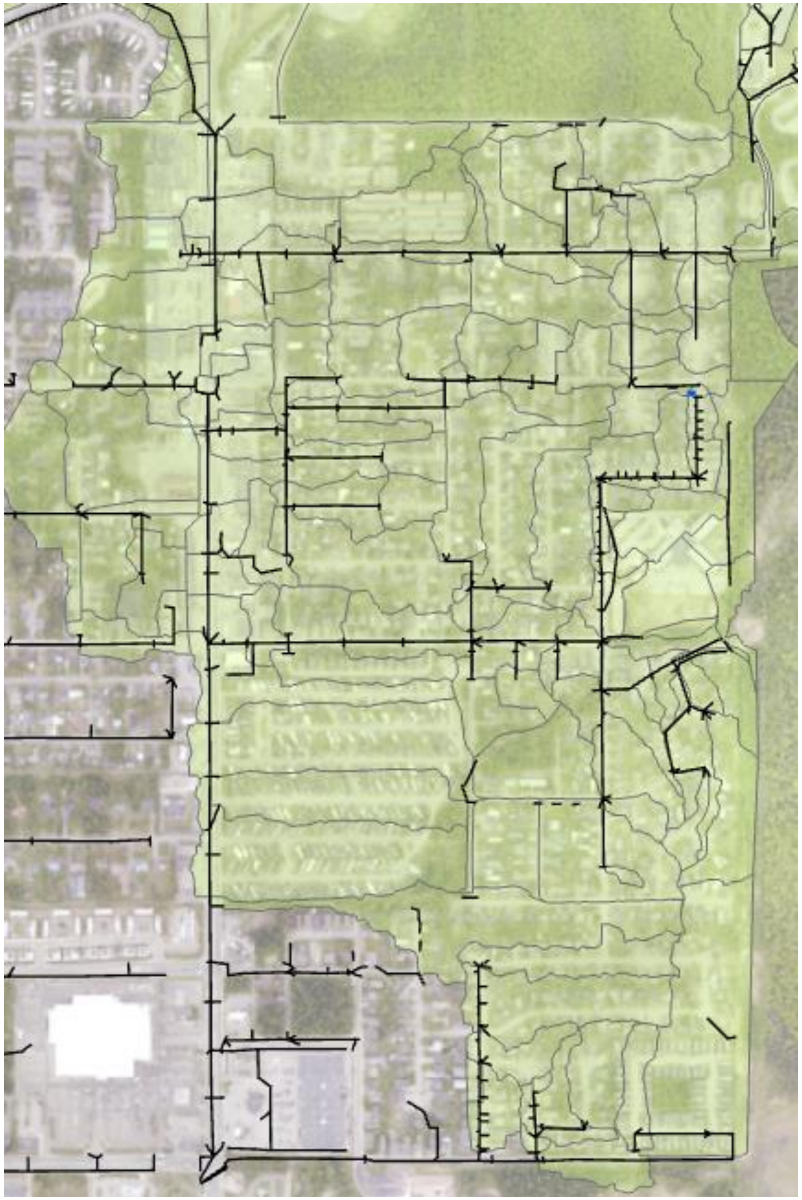
HYDROLOGIC & HYDRAULIC ASSESSMENT



HYDROLOGIC & HYDRAULIC ASSESSMENT

- Level of Detail
  - Subbasin Delineation
  - Pipes included in the analysis

- Example to the right



HYDROLOGIC & HYDRAULIC ASSESSMENT

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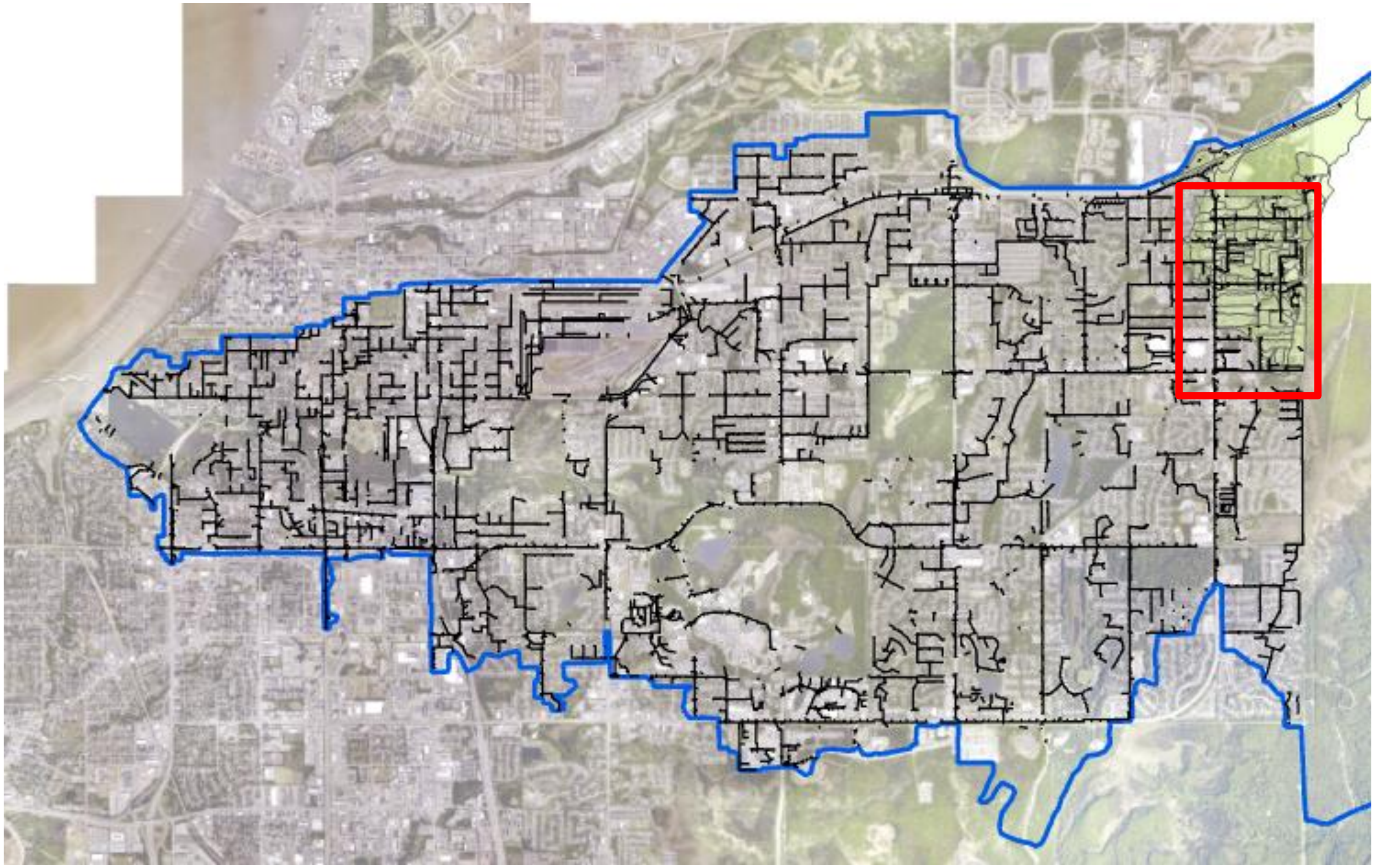

HYDROLOGIC & HYDRAULIC ASSESSMENT

- Level of Detail
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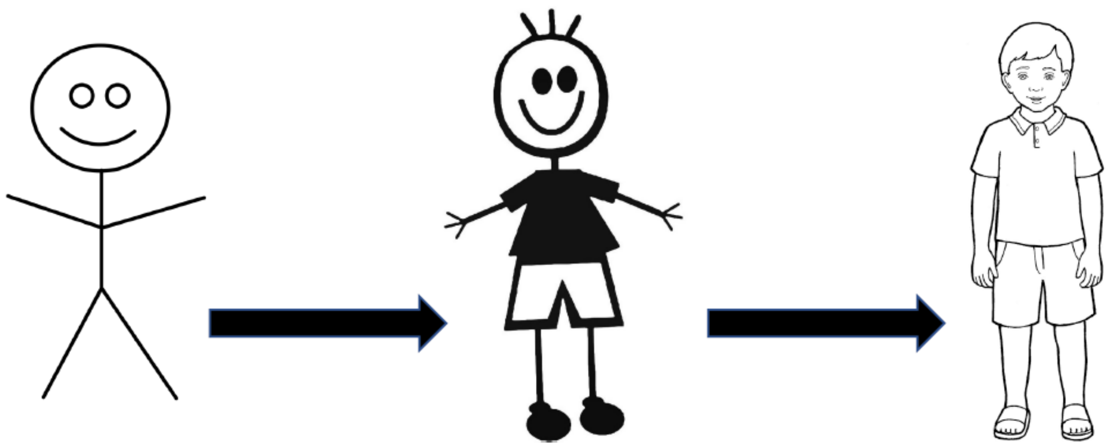


HYDROLOGIC & HYDRAULIC ASSESSMENT

- Level of Detail
  - 24-inch pipes or greater were included in the model
  - Total watershed pipes shown below

Table 1: Pipe Diameter and Length of Pipe

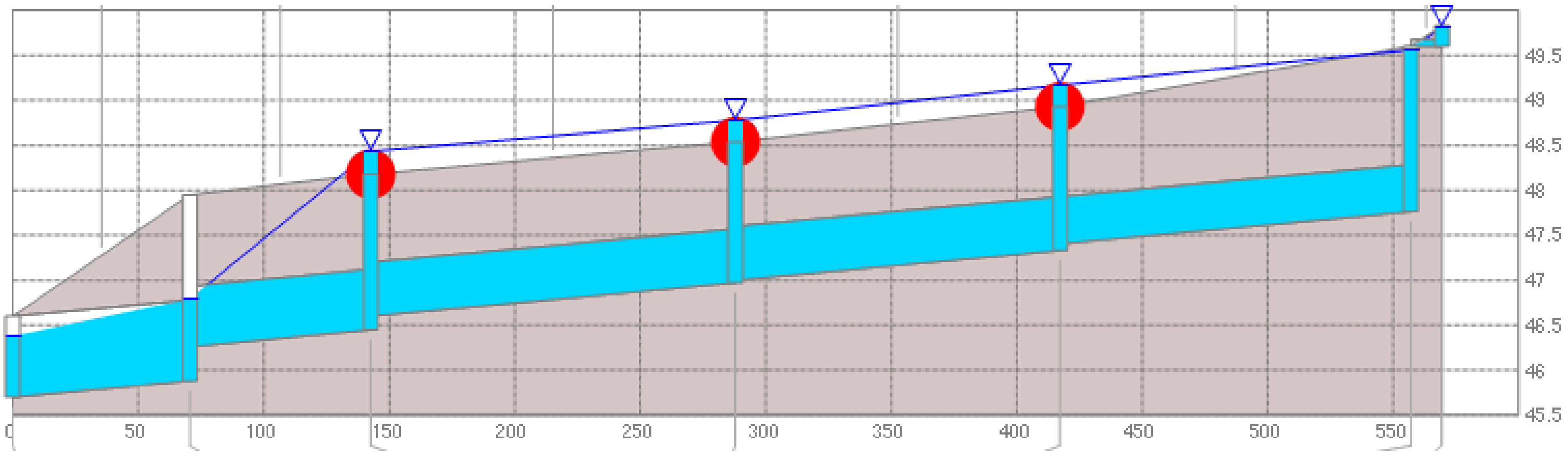
Pipe Diameter	Length of Pipe (mi)
< 12 inches	7
12-16 inches	32
18-21 inches	26
24-30 inches	21
36-42 inches	12
48 inches	5
> 48 inches	4
Unknown	17

HYDROLOGIC & HYDRAULIC ASSESSMENT

- Level of Detail
  - 31 square miles
  - 222 sub-basins

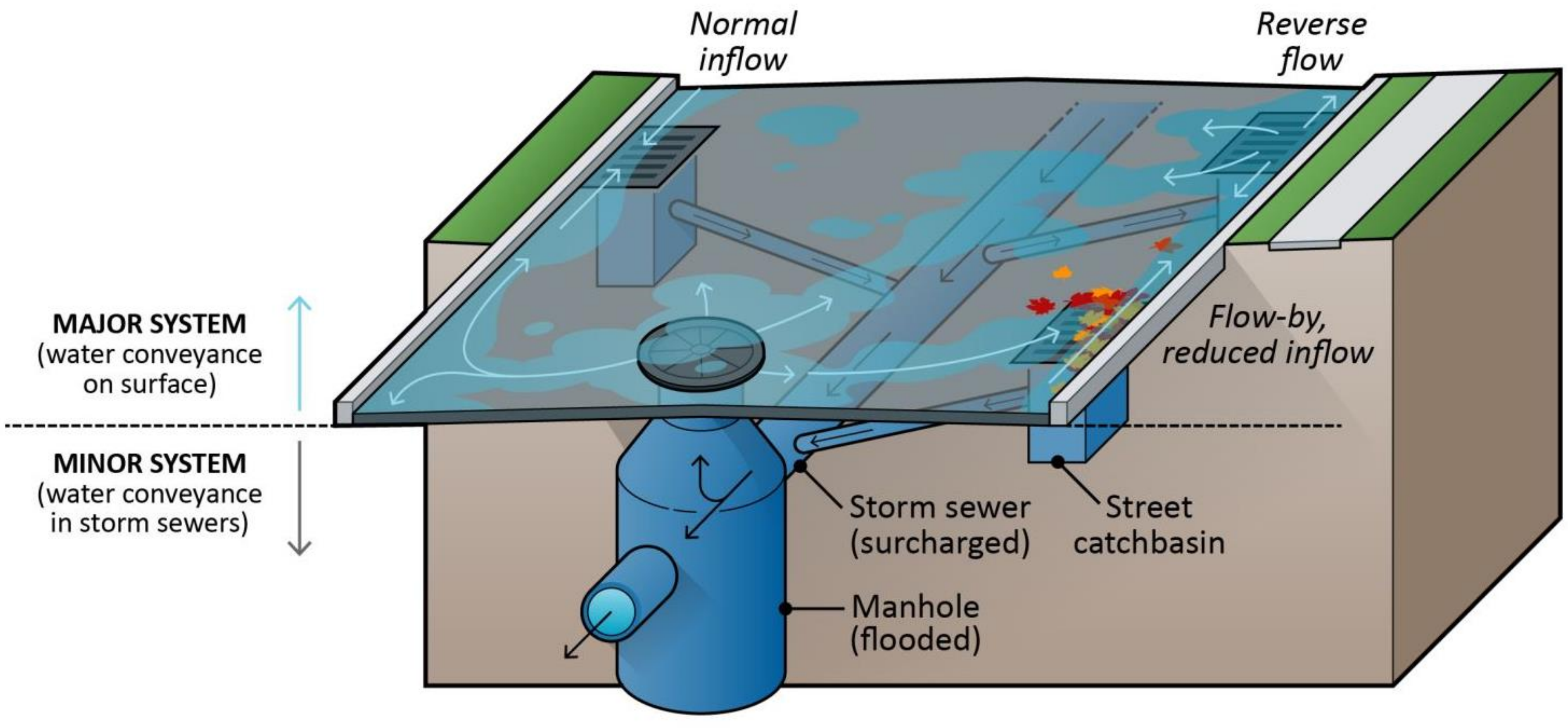
HYDROLOGIC & HYDRAULIC ASSESSMENT

- **Hydraulic Approach**
  - Piped network
  - 2D Surface Flooding



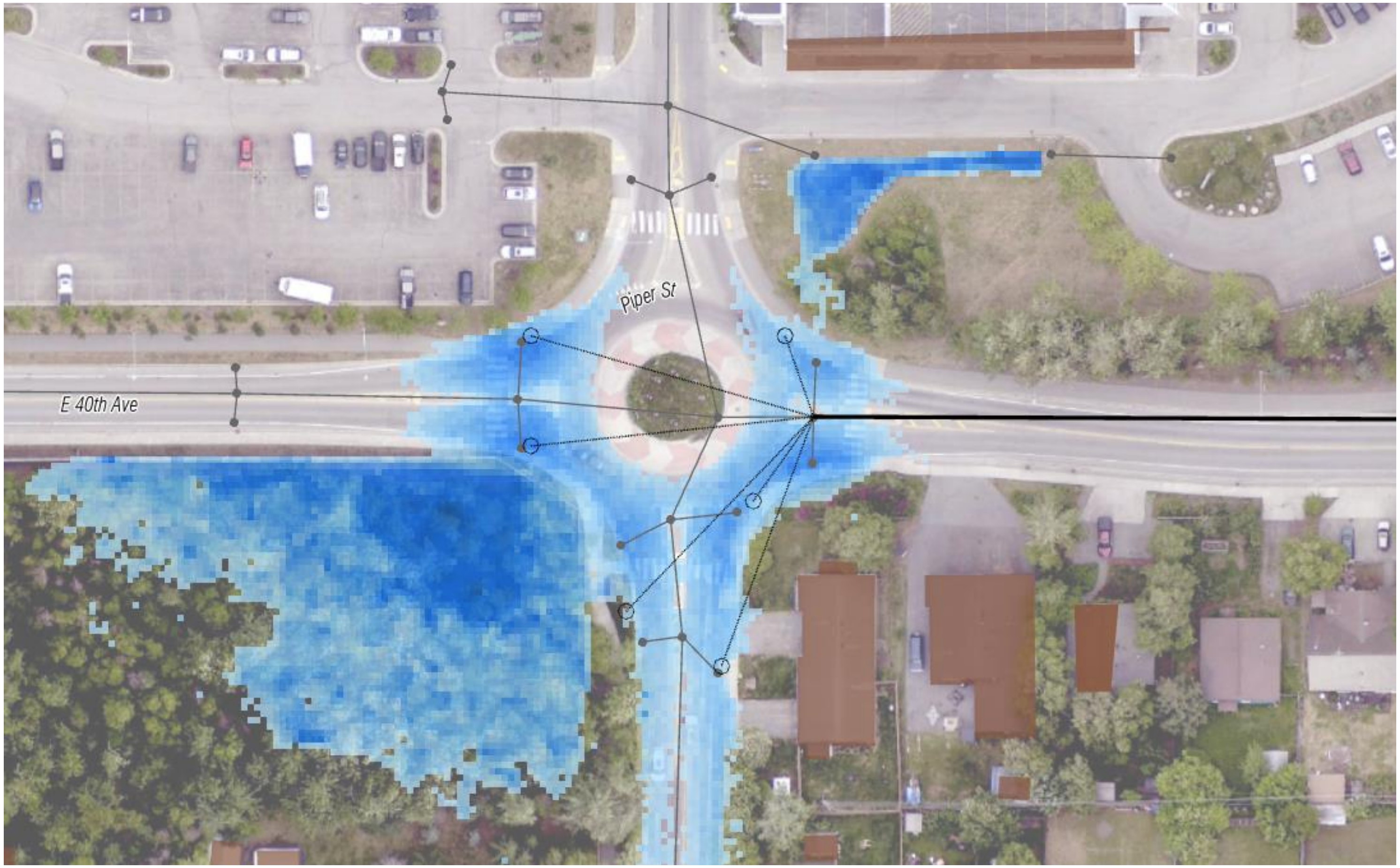
HYDROLOGIC & HYDRAULIC ASSESSMENT

- **Hydraulic Approach**
  - Piped network
  - 2D Surface Flooding



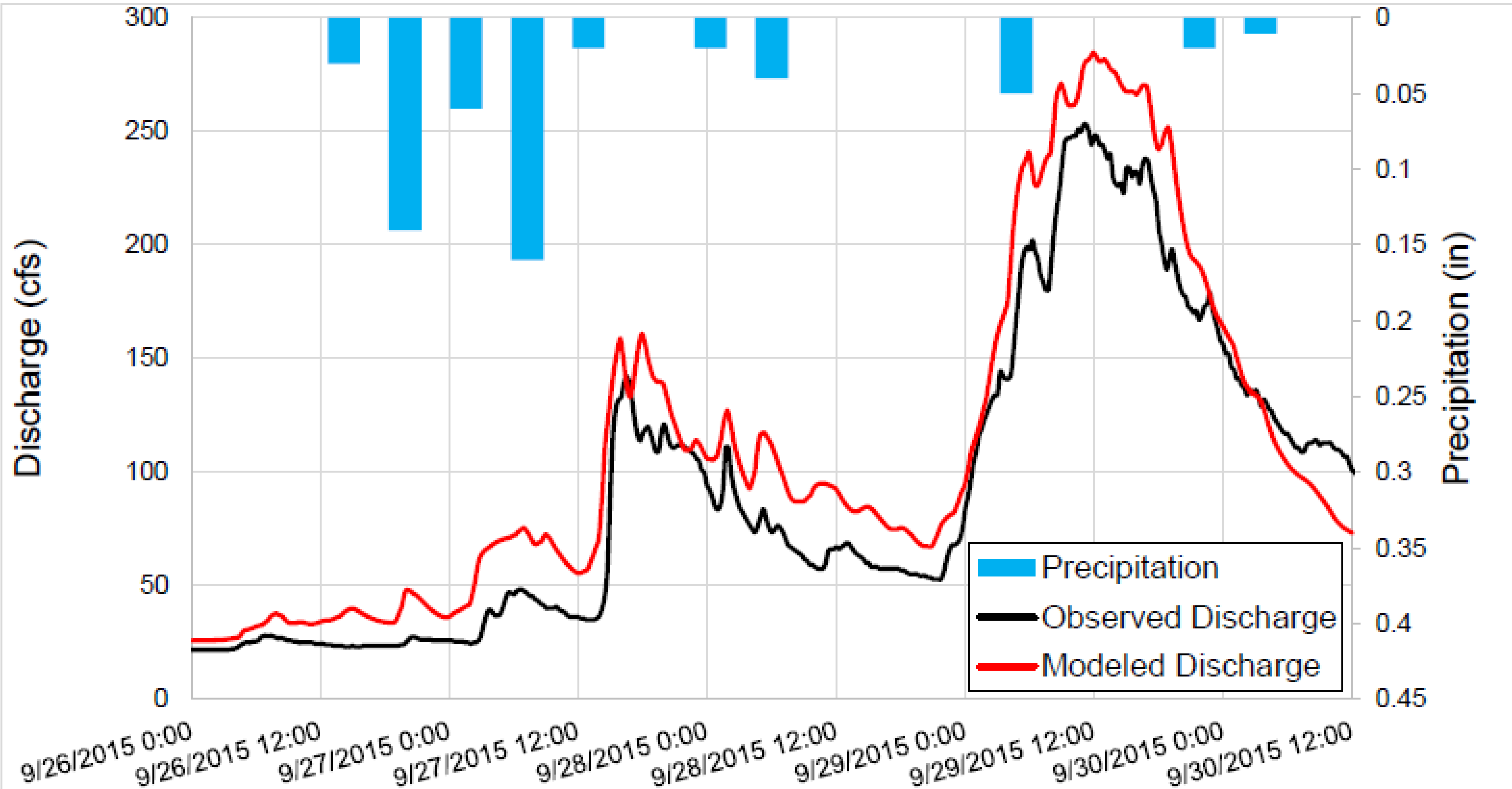
HYDROLOGIC & HYDRAULIC ASSESSMENT

- **Hydraulics**
  - 2D surface flows
  - Surface links - Flooding not limited to modeled pipe corridors



HYDROLOGIC & HYDRAULIC ASSESSMENT

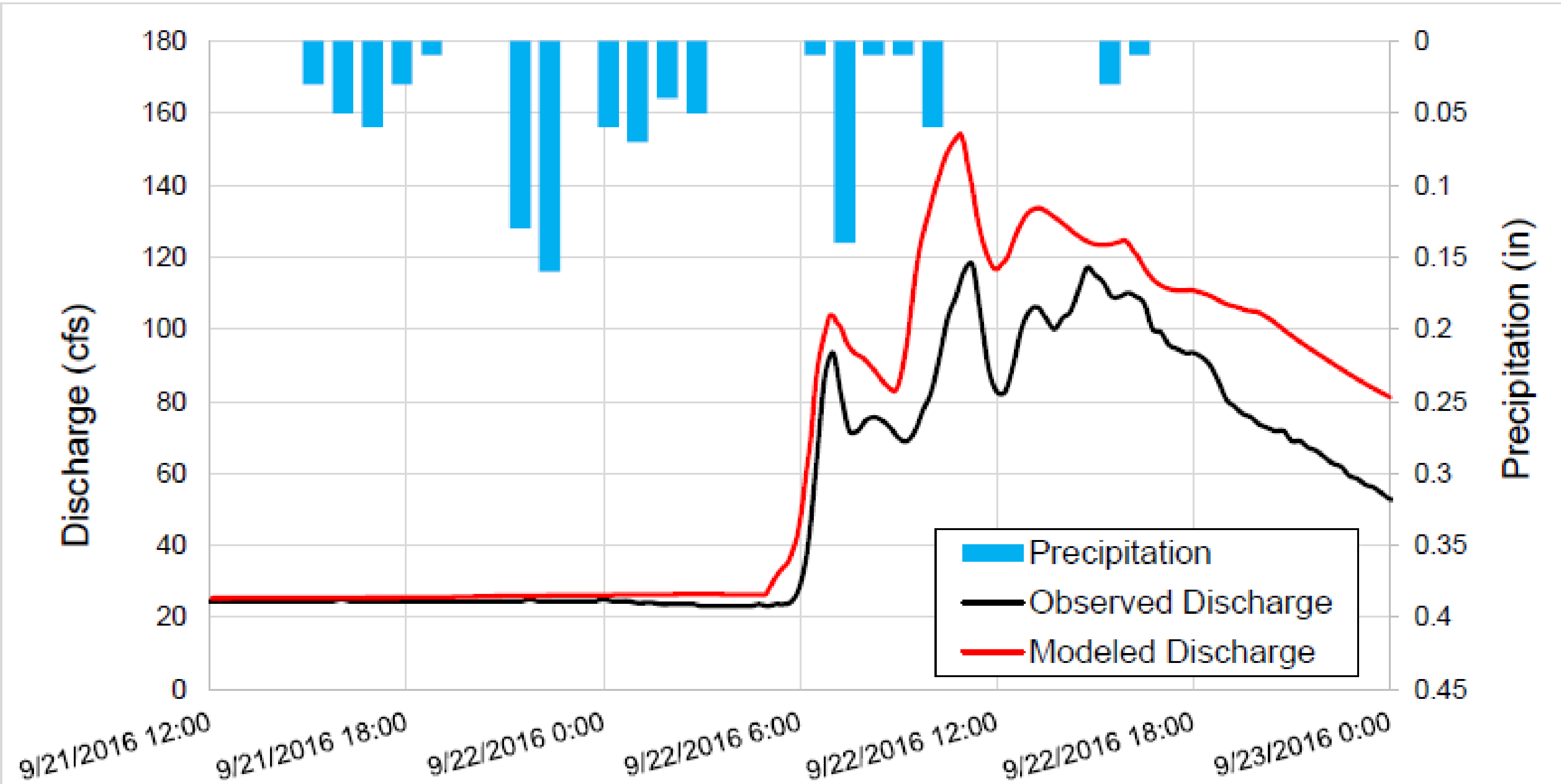
- **Calibrated Rainfall Runoff Model**



September 26th and 27th of 2015 with a total rainfall of 0.41 inches

HYDROLOGIC & HYDRAULIC ASSESSMENT

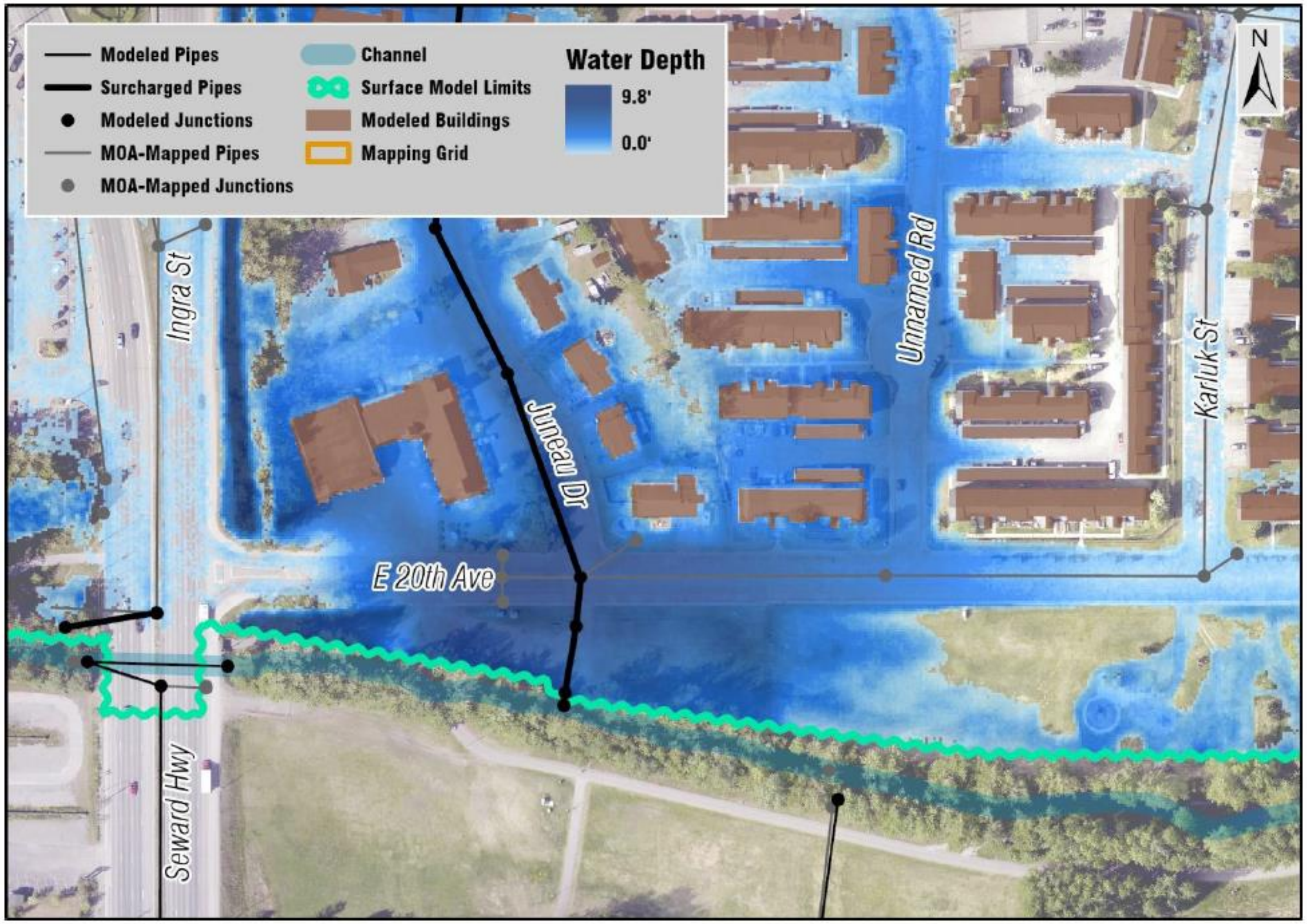
- **Calibrated Rainfall Runoff Model**



September 21st through 23rd of 2016 with a total rainfall of 0.76 inches

HYDROLOGIC & HYDRAULIC ASSESSMENT

- **Hydraulics**
  - Chester Creek
    - Stormwater Master Plan vs Creek Flood Study



HYDROLOGIC & HYDRAULIC ASSESSMENT

- **Results**

Show in Map

HYDROLOGIC & HYDRAULIC ASSESSMENT

- **Keeping the Model Current**
  - **Working on a pathway and strategy for this**
  - **Still in process**

RISK ASSESSMENT

- General Approach

(Probability of Failure) x (Consequence of Failure) = Total Risk

- Risk Assessment included all main line pipes – not limited to pipes 24-inches and greater

RISK ASSESSMENT

- **Probability of Failure**

Table 2: Factors Contributing to Probability of Failure

Factor	Relevant Pipe Types	Weight	Scoring Value				
			1	2	3	4	5
Remaining Useful Life (% Range)	All Pipes	5	75+	50 - 75	25 - 50	1 - 25	Past Useful Life
Problem Area Identified by Street Maintenance, (flag value)	Plastic and Metal Pipes	1	Not Flagged				Flagged
Proximity to Historic Wetlands (feet)	Metal Pipes	2	>50 ft		0 - 50 ft		Intersecting or inside
Contributing Impervious Area (acres, range)	Plastic and Metal Pipes	2	Not Modeled	0	1 - 35	36 - 47	48 - 60

- **Weights were calibrated based on observed CCTV of pipes in the Watershed.**

RISK ASSESSMENT

- **Probability of Failure**
  - Probability of Failure scores were grouped in 4 categories
    Good | Moderate | Poor | Failing

  - Weights were calibrated based on observed CCTV of pipes in the Watershed.

Table 3: Comparison of Probability of Failure to Observed CCTV Data

Parameter	Concrete Pipes		Metal Pipes		Plastic Pipes		All Pipes	
	Count	%	Count	%	Count	%	Count	%
Sample Size	25	100%	157	100%	60	100%	242	100%
Match to Observed CCTV Condition Category								
Exact Match	13	52%	66	42%	36	60%	115	48%
One category off	11	44%	72	46%	19	32%	102	42%
Two categories off	1	4%	19	12%	5	8%	25	10%
Three categories off	0	0%	0	0%	0	0%	0	0%
Exact + One off	24	96%	138	88%	55	92%	217	90%

RISK ASSESSMENT

- **Probability of Failure**
  - Final scores were distributed to a 1 to 10 scale

Table 4: Probability of Failure Ratings and Scores

Pipe Rating	Probability Score
Good	1-3
Moderate	4-6
Poor	7-8
Failing	9

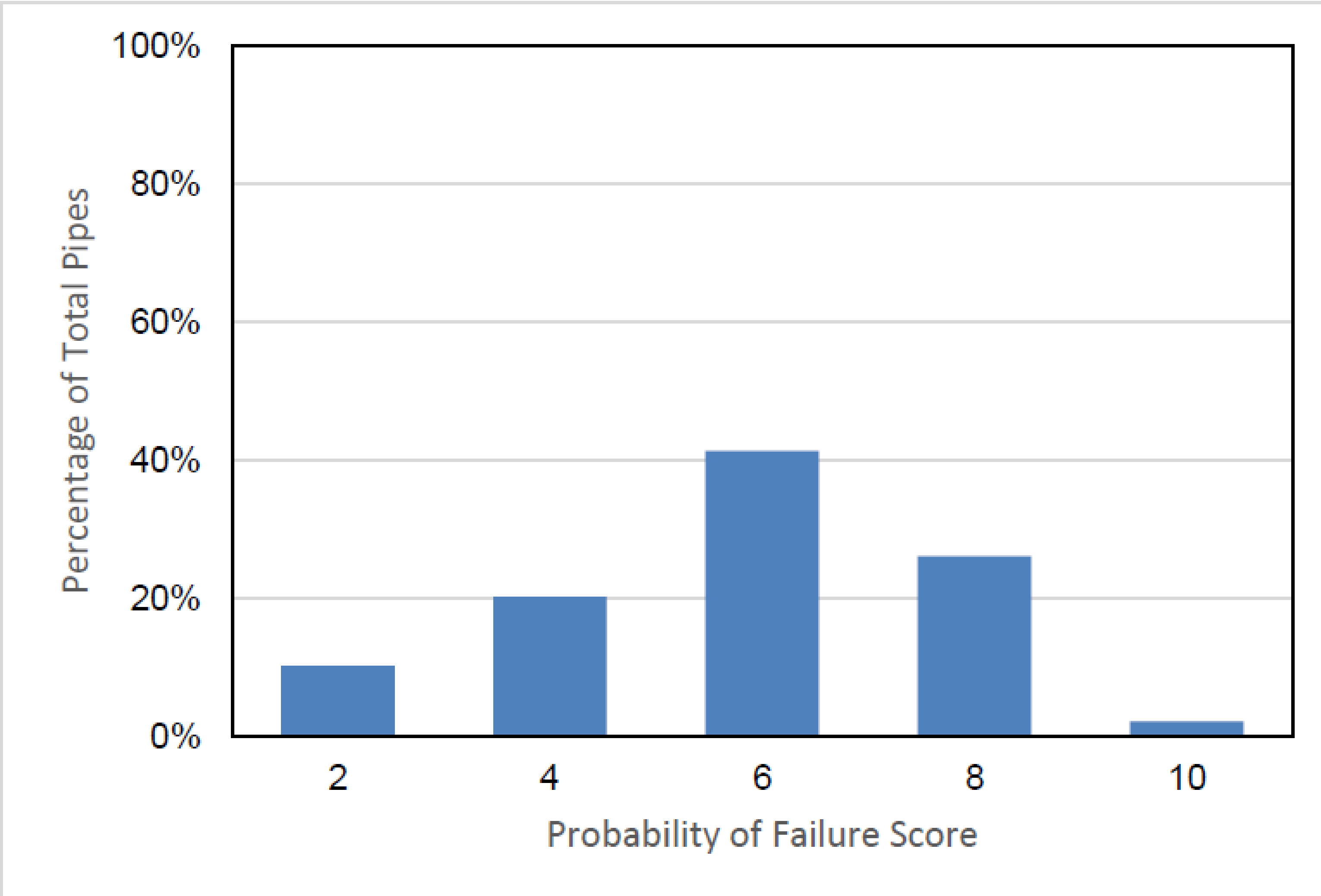
RISK ASSESSMENT

- **Probability of Failure**

Show in PDF Maps

RISK ASSESSMENT

- **Probability of Failure**



RISK ASSESSMENT

Table 7: Factors Contributing to Consequence of Failure

Factor	Weight	Scoring Value				
		1	2	3	4	5
Pipe Diameter or Rise (inches)	5	0 to 11	12 to 23	24 to 35	36 to 47	48 or larger
Road Classification	5	No Road	Local	Secondary		Major
Proximity to Current Wetlands, Streams, Ponds, or Lakes (feet)	1	Greater than 50		0 to 50		Intersecting or Inside
Outside ROW (flag value)	2	No				Yes
Proximity to Buildings (feet)	2	Greater than 20		Greater than 10 to 20		10 or less
Peak Flow for 10-year Event (cfs)	2	Not Modeled	Less than 5	5 to less than 15	15 to less than 30	30 or more

RISK ASSESSMENT

- **Final Risk Score**

(Probability of Failure) x (Consequence of Failure) = Total Risk

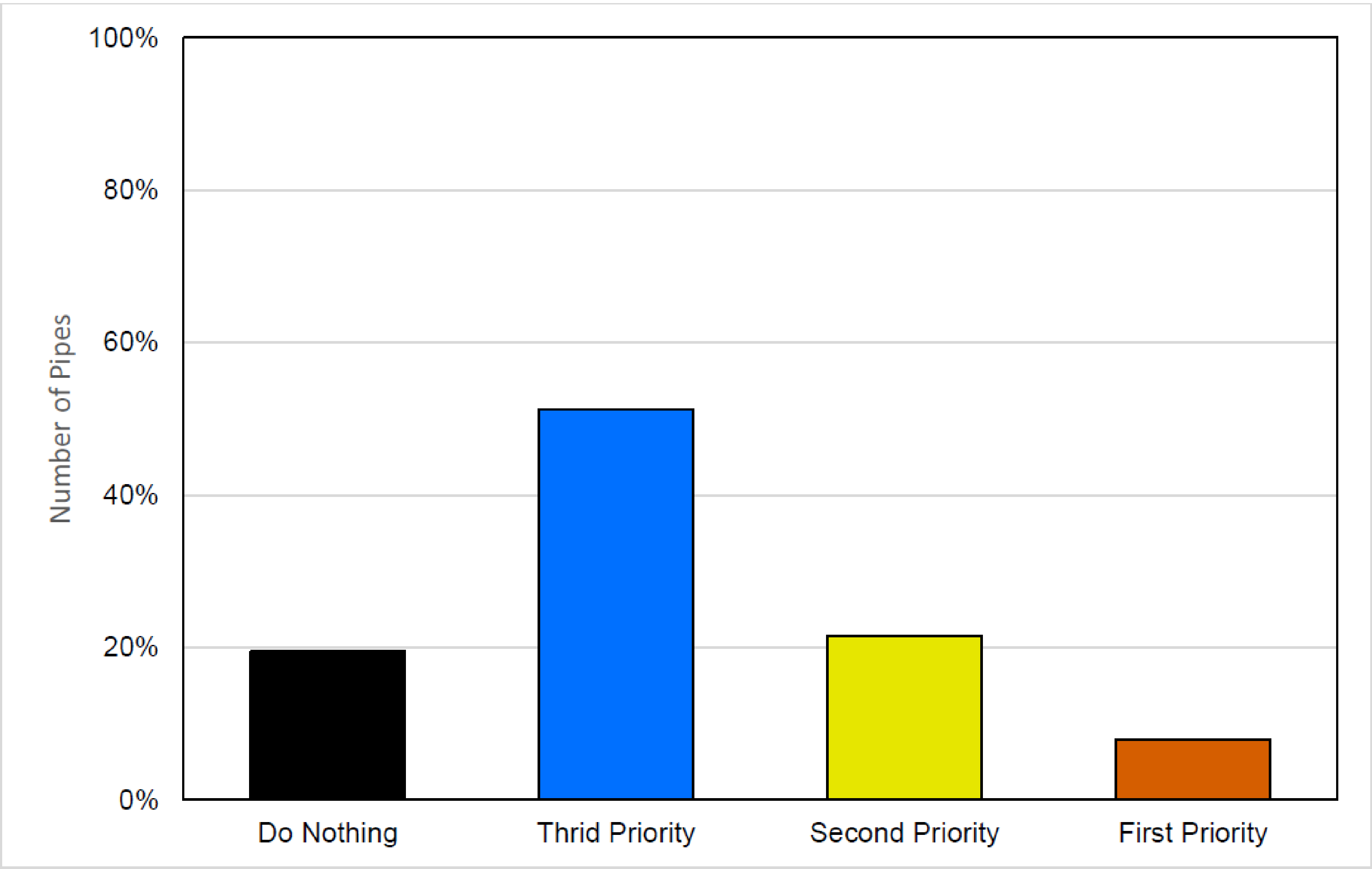
Table 8: Final Risk Score Categories

Risk Value	Risk Category
0 to 15	Do Nothing
16 to 35	Third Priority
36 to 60	Second Priority
61 to 100	First Priority

RISK ASSESSMENT

- **Final Risk Score**

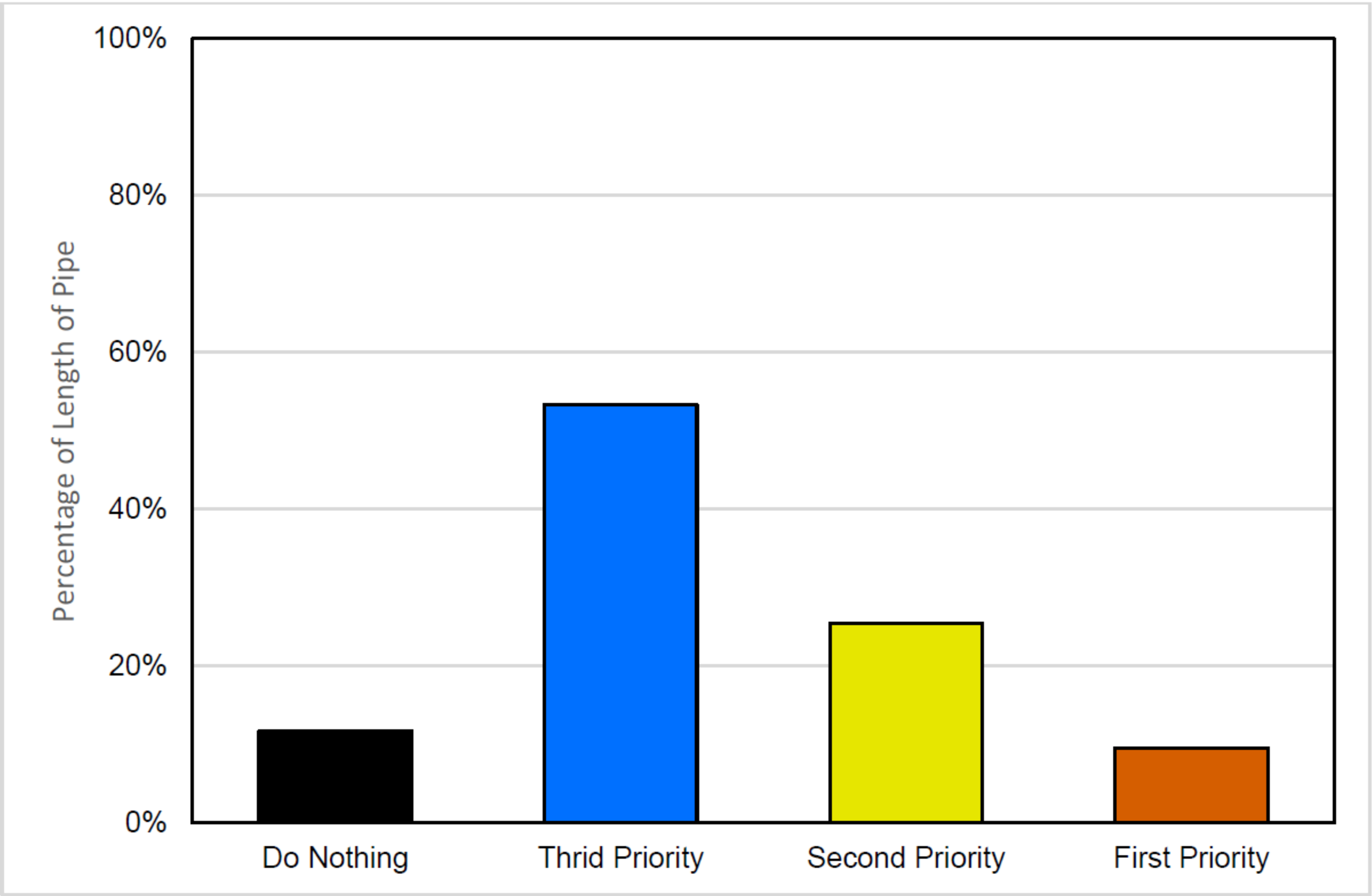
Exhibit 5: Risk Assessment Results (By Number of Pipes)



RISK ASSESSMENT

- **Final Risk Score**

Exhibit 6: Risk Assessment Results (By Length of Pipes)



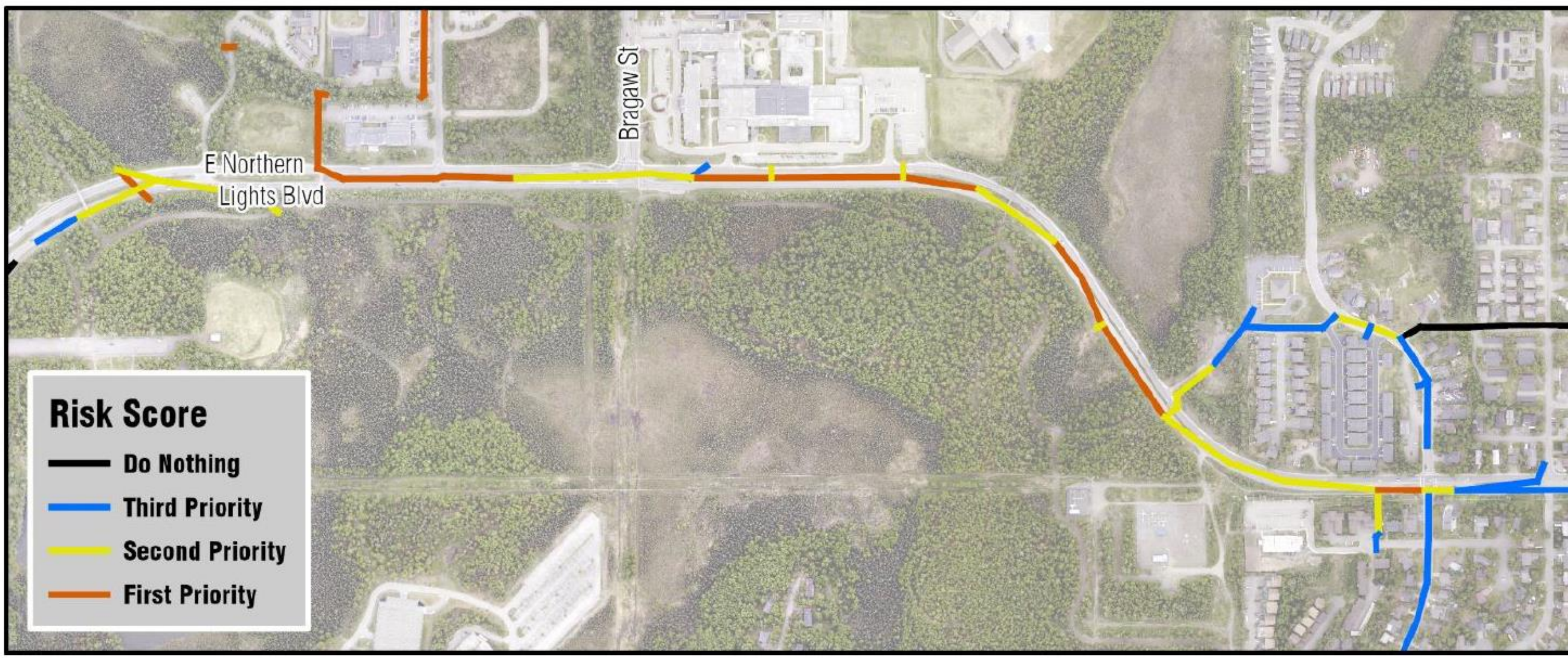
RISK ASSESSMENT

- **Final Risk Score**

Show in PDF Maps

RISK ASSESSMENT

- **Interpretation of Results**
  - Not a perfect representation of the real world
  - Look at the system more holistically and not segment-by-segment
  - Risk is based on input priorities



APPLICABILITY

- **Storm drain design and sizing**
- **Baseline for fine-tuning piece-by-piece**
- **Prioritizing upgrades**
- **Understanding existing pipe capacity and condition for new development tie-ins**

DATA AVAILABILITY

- **Chester Creek Stormwater Master Plan Story Map**
  - Chester Creek Watershed Stormwater Master Plan (arcgis.com)
    - https://storymaps.arcgis.com/stories/97f06fa6e00a4785af53514e1fb83bd1
  - **Documents and Resources**
    - **Report (Chester Creek Watershed Stormwater Master Plan)**
    - **Figures and Appendices**
    - **Presentation Slides**
    - **Interactive Map**
    - **Spatial Data Download**
      - **Model Pipe Results**
      - **Model Junction Results**
      - **Surface flow rasters**
      - **Subcatchments**
      - **Mapping Grid**

QUESTIONS?