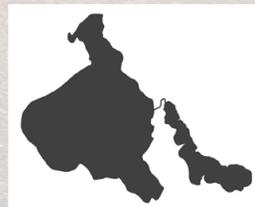


Jackfish and Murray Lakes Development Study

End of Summer Engagement
August 2021



JACKFISH AND MURRAY LAKES
DEVELOPMENT STUDY

PROJECT OVERVIEW

Municipalities surrounding Jackfish and Murray Lakes commissioned a Development Study to measure key environmental and physical characteristics against historical information and data to determine:

- How the current level of development affects the lakes
- How to manage land use and development while protecting and preserving the natural and recreational attributes the lakes provide.

The results of the Study will help local authorities cooperate with one another to better preserve and manage development, land use, infrastructure and the natural environment surrounding the lakes.

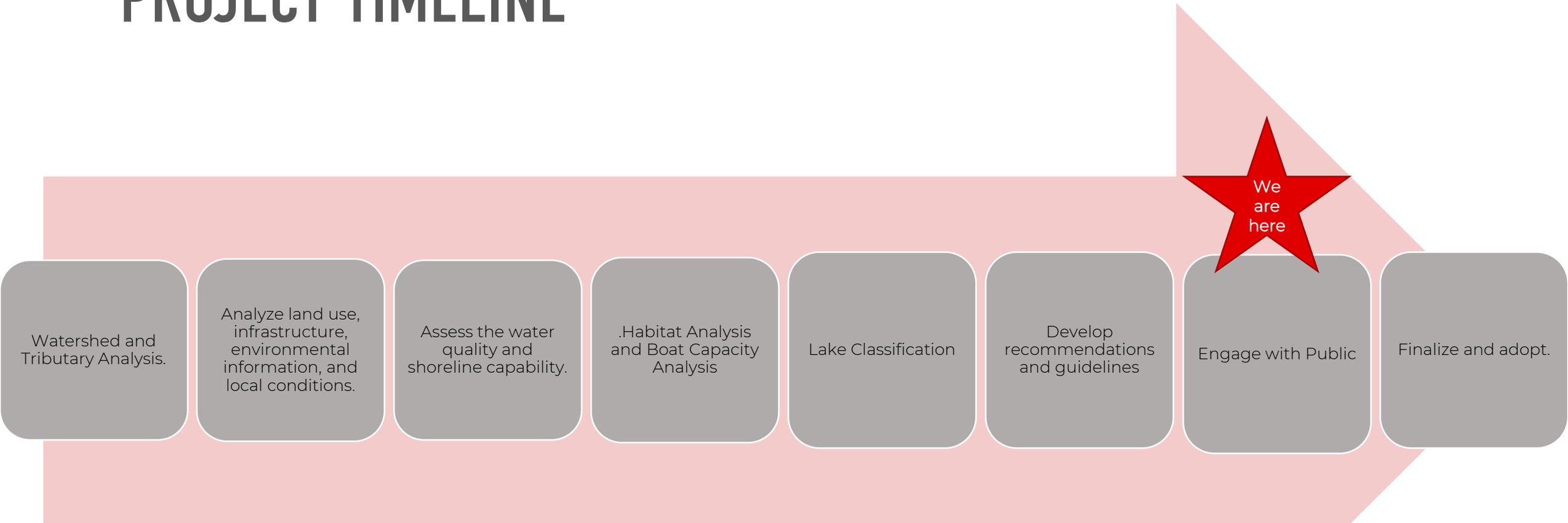


PROJECT TASKS

- Watershed & tributary analysis
- Land use analysis
- Infrastructure assessment
- Field analysis including water sampling and habitat assessment
- Environmental analysis
- Shoreline capability
- Boat usage and capacity
- Lake classification based upon development capacity
- Public engagement (stakeholder questionnaire and online public survey)



PROJECT TIMELINE



JACKFISH AND MURRAY LAKES
DEVELOPMENT STUDY

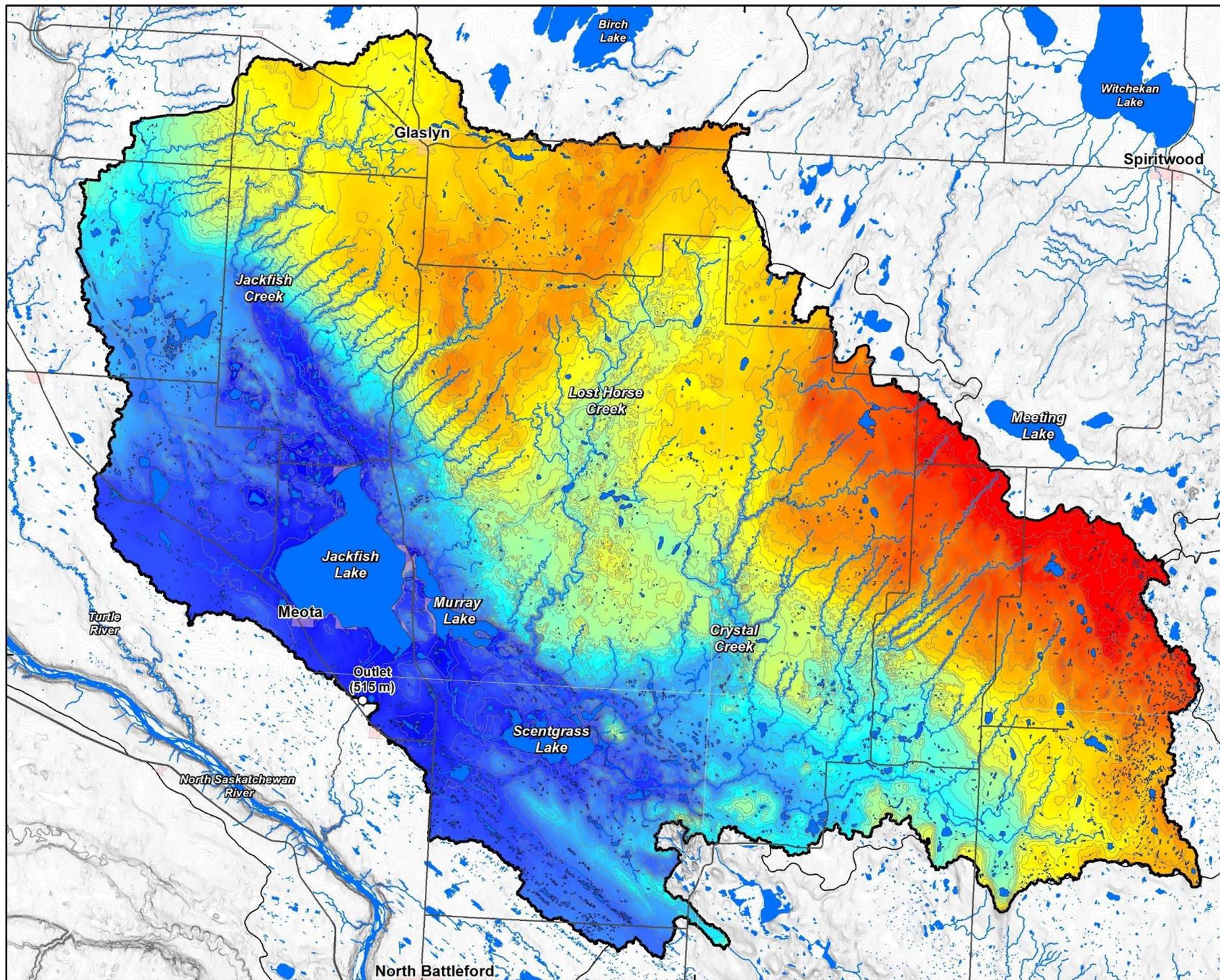
ENVIRONMENTAL CONSIDERATIONS

This includes the following tasks:

- Desktop review of previous data and information
- On-site assessment of water quality, vegetation, riparian areas, fish, wildlife, topography, erosion, etc.
- Assess supporting habitat for Species at Risk
- Wetlands and tributaries
- Historical use and activities
- Current land use - Local (boating, vegetation removal, shoreline development, fishing) Regional (adjacent land use, agriculture, infrastructure, industry)
- Cumulative effects
- Best management practices and mitigation measures
- Environmental Acts, Regulations and Guidelines (Federal, Provincial and Municipal)



TOPOGRAPHY OF SUB-BASIN



LEGEND

Hydrology

- Waterbodies
- Streams
- NHN Watershed Boundary
- Jackfish Lake Sub-Basin Boundary

Base

- Communities
- Roads

Topography

- 800 m
- Elevation
- 515 m
- Elevation Contours (10 m)

Study Area

Scale: 0 2.25 4.5 9 13.5 Kilometers
Scale 1:275,158
NAD 1983 UTM Zone 13N

CLIENT: Urban Systems

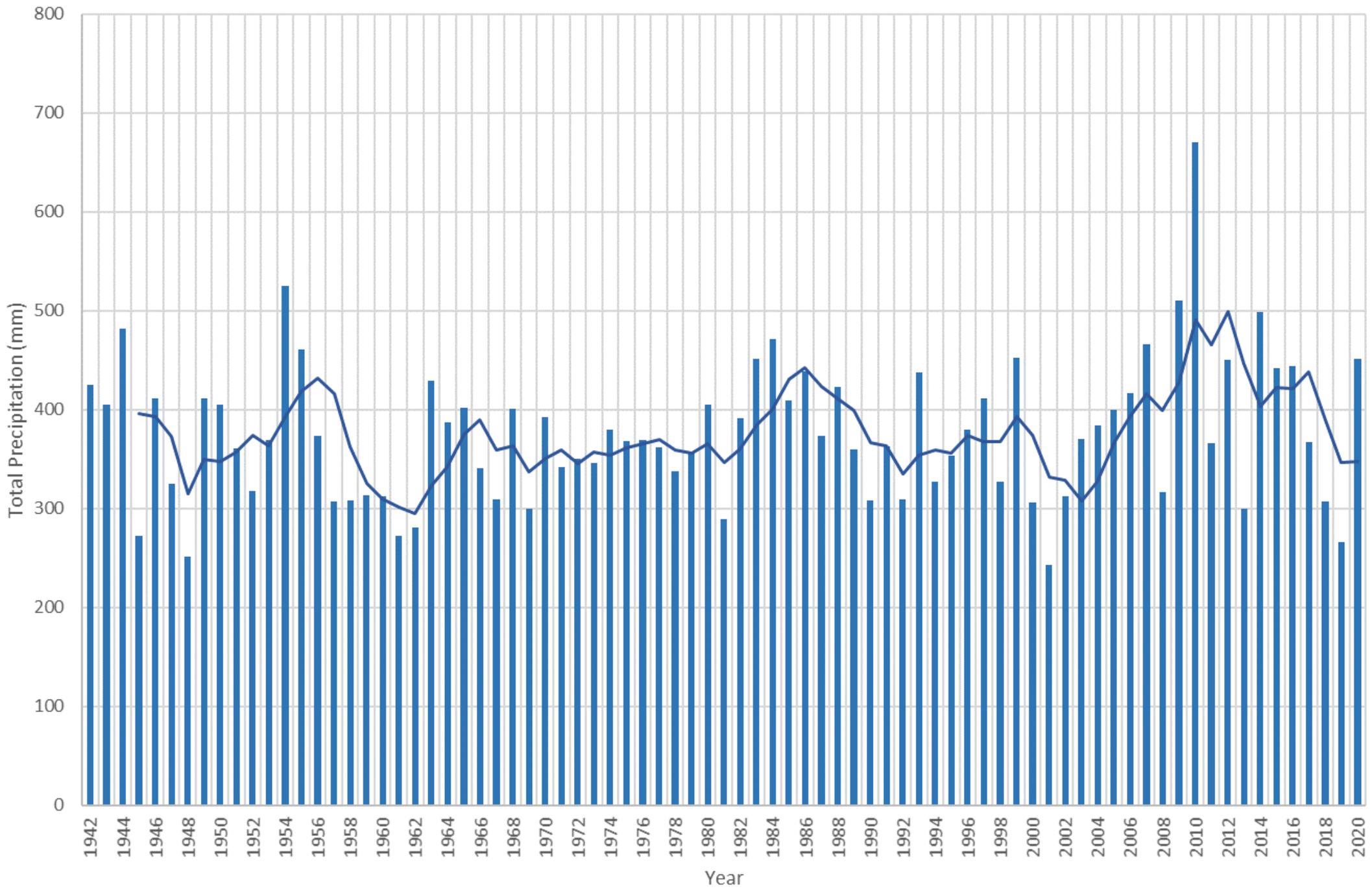
FIGURE: Figure 3

TITLE: Topography of the Jackfish and Murray sub-basin

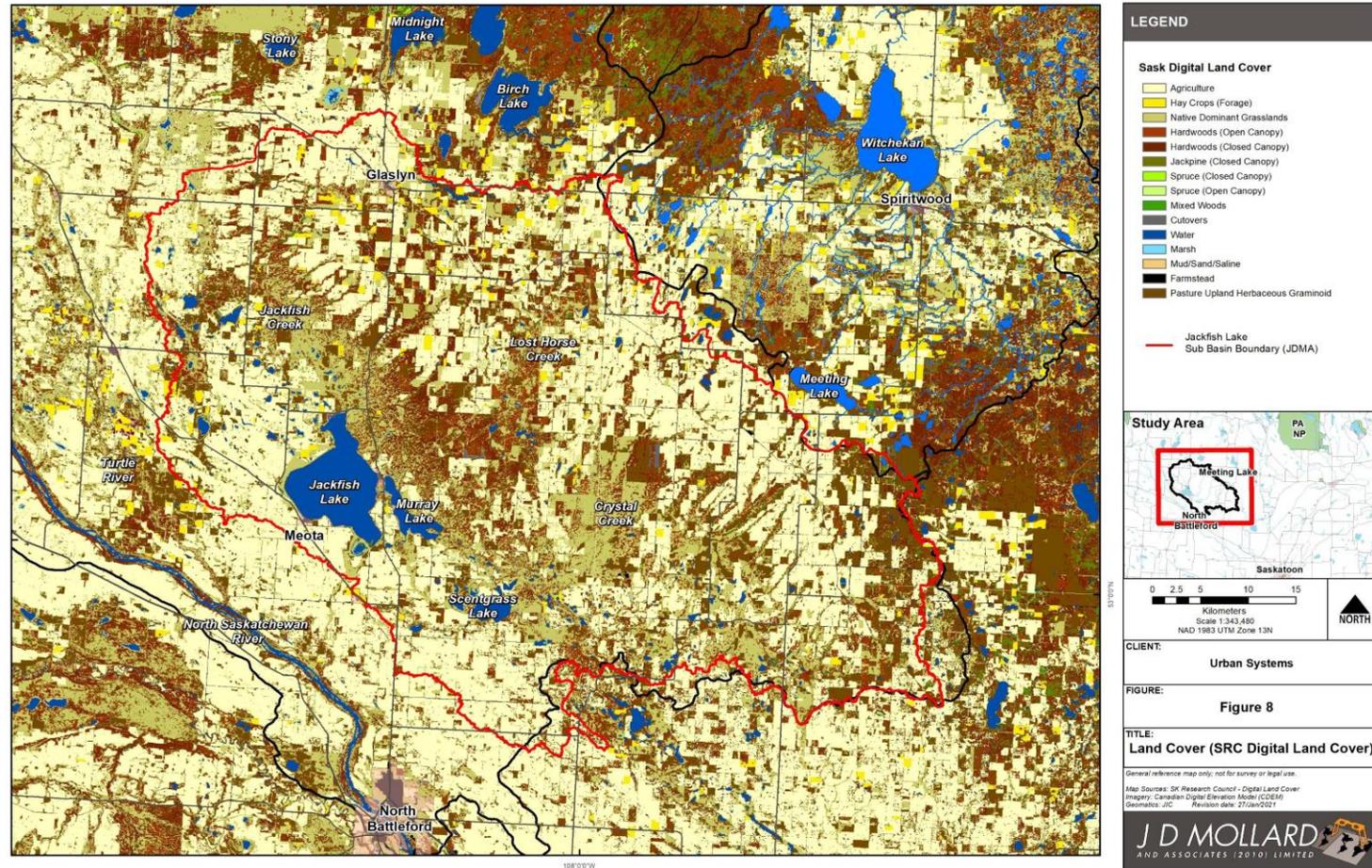
General reference map only; not for survey or legal use.

Map Sources: Base Data: CanVec
Imagery: Canadian Digital Elevation Model (CDEM)
Geomatics: JIC Revision date: 09/Dec/2020

ANNUAL TOTAL PRECIPITATION AND 5-YEAR MOVING AVERAGE

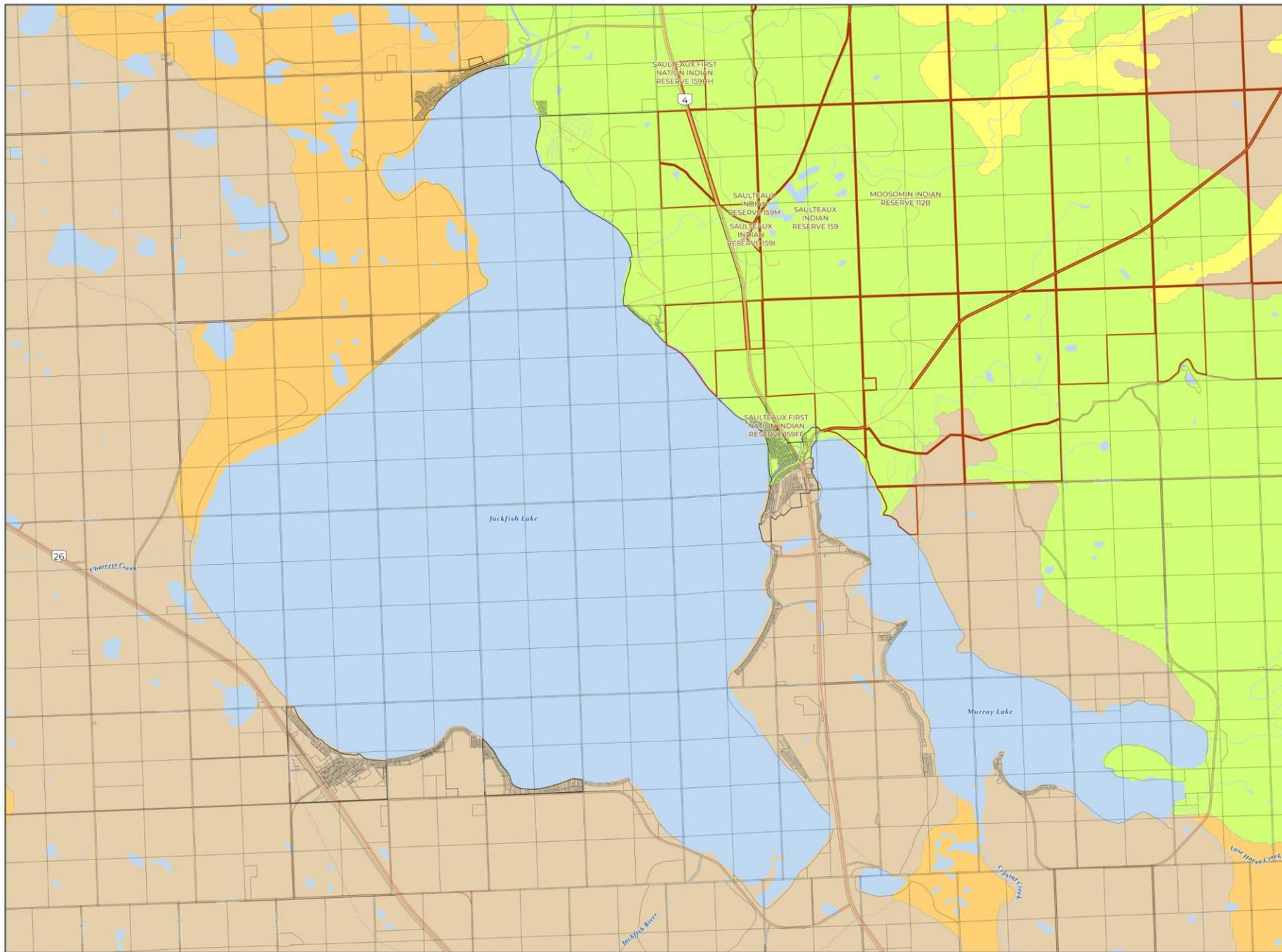


CHANGE IN LAND COVER BETWEEN 1987 AND 2018



Class	1987 (km ²)	2018(km ²)	% Change
Trees/Vegetation	929	847	-9%
Agriculture	2281	2298	+0.75%
Water	145	209	+44%

SOIL CAPABILITY FOR AGRICULTURE



Rural Municipality of Meota
 Jackfish Lake and Murray Lake Study
 Soil Capability for Agriculture

- Legend**
- Rural Municipality
 - First Nation Reserve
- Soil Capability for Agriculture**
- 2 - Moderate Limitations; moderate conservation practices required
 - 3 - Moderately Severe Limitations; range of crops restricted or special conservation practices required
 - 5 - Forage Crops - Improvement practices feasible
 - 6 - Forage Crops - Improvement practices not feasible
 - 8 - Unclassified Areas

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

0 500 1000 1500
 Meters

Scale: 1:30,000
 (When plotted at 22"x34")

Coordinate System:
 NAD 1983 UTM Zone 12N

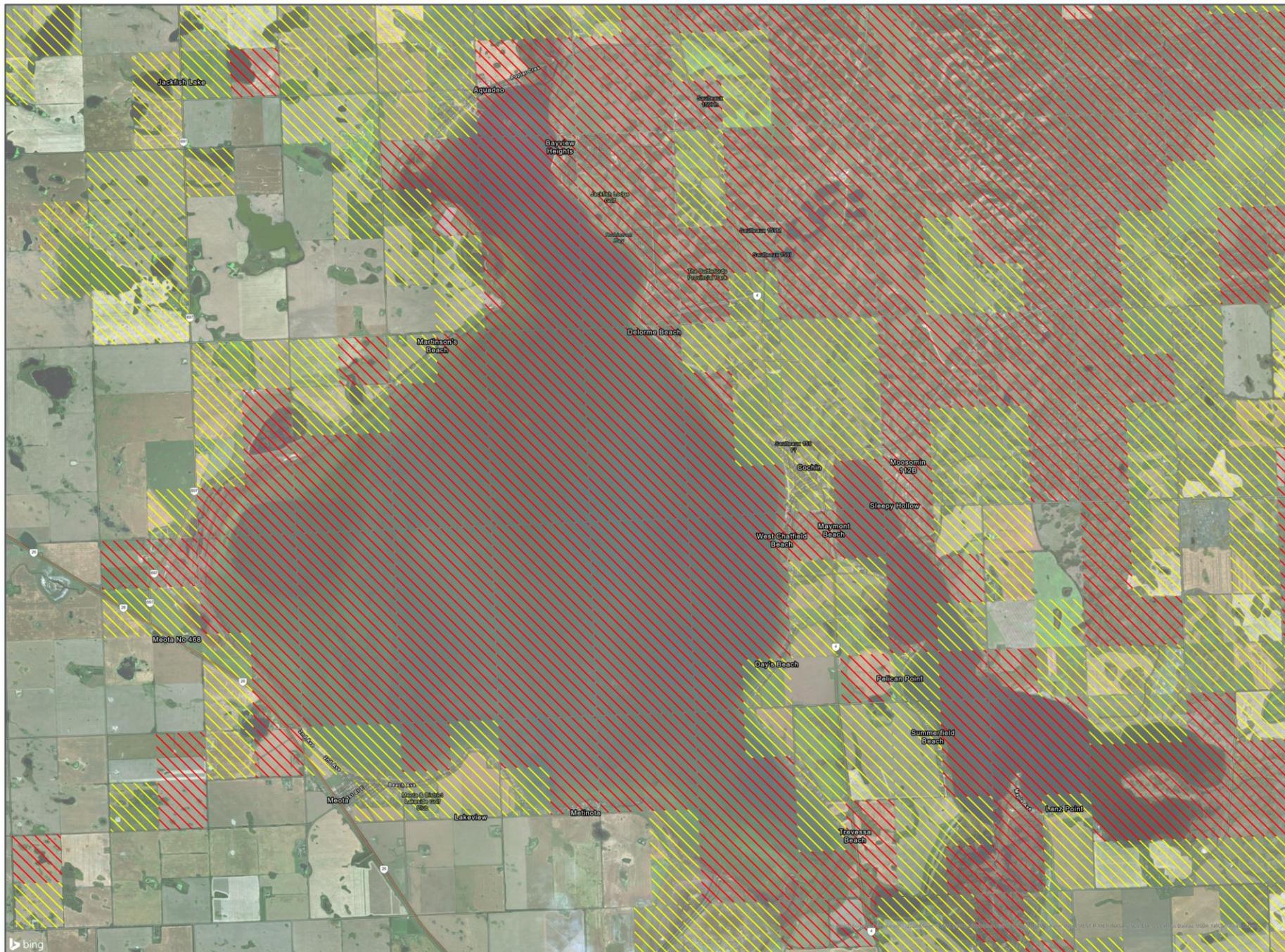
Data Sources:
 - Data provided by Bing, Government of Saskatchewan, Canada Land Inventory

Project #: 4610.0003.02
 Author: AK
 Checked: CW
 Status: **DRAFT**
 Revision: A
 Date: 2020/11/23

URBAN SYSTEMS

FIGURE XX

HERITAGE SENSITIVITY



Rural Municipality of Meota

Jackfish Lake and Murray Lake Study Heritage Sensitivity

- Legend**
- Heritage Sensitivity**
- Conditionally Sensitive
 - Sensitive

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

0 500 1000 1500
Meters

Scale: 1:30,000
(When plotted at 22"x34")

Coordinate System: NAD 1983 UTM Zone 12N

Data Sources:
- Data provided by Bing, Heritage Conservation Branch

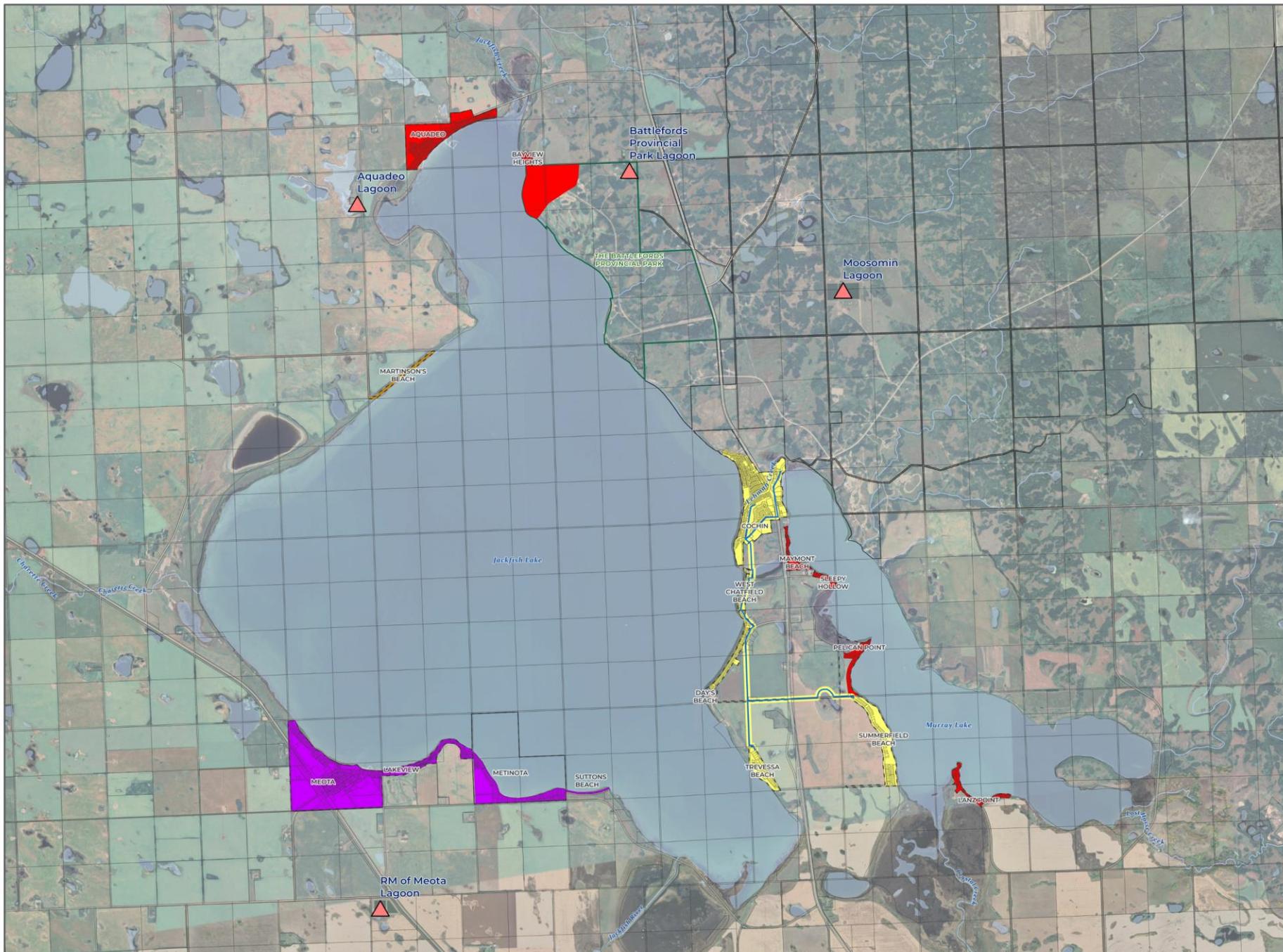
Project #: 4610.0003.02
Author: AK
Checked: CW
Status: **DRAFT**
Revision: A
Date: 2020/11/19



FIGURE XX

Last updated by akh/meriva on November 18, 2020 at 8:34 AM
Last exported by akh/meriva on September 25, 2017 10:45 AM
Last printed by akh/meriva on September 25, 2017 10:46 AM

WATER & WASTEWATER SERVICES



Jackfish Lake and Murray Lake Study Water & Wastewater Services

- Legend
- Rural Municipality
 - Urban Municipality
 - Park
 - Independent Water Systems
 - Interlake Water Utility Service Area
 - Jackfish Lake West Water Utility Corp. Service Area
 - No known Water System
 - Water Main
 - ▲ Lagoons

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

0 500 1000 1500
Meters

Scale: 1:32,000
(When plotted at 22"x34")

Coordinate System:
NAD 1983 UTM Zone 12N

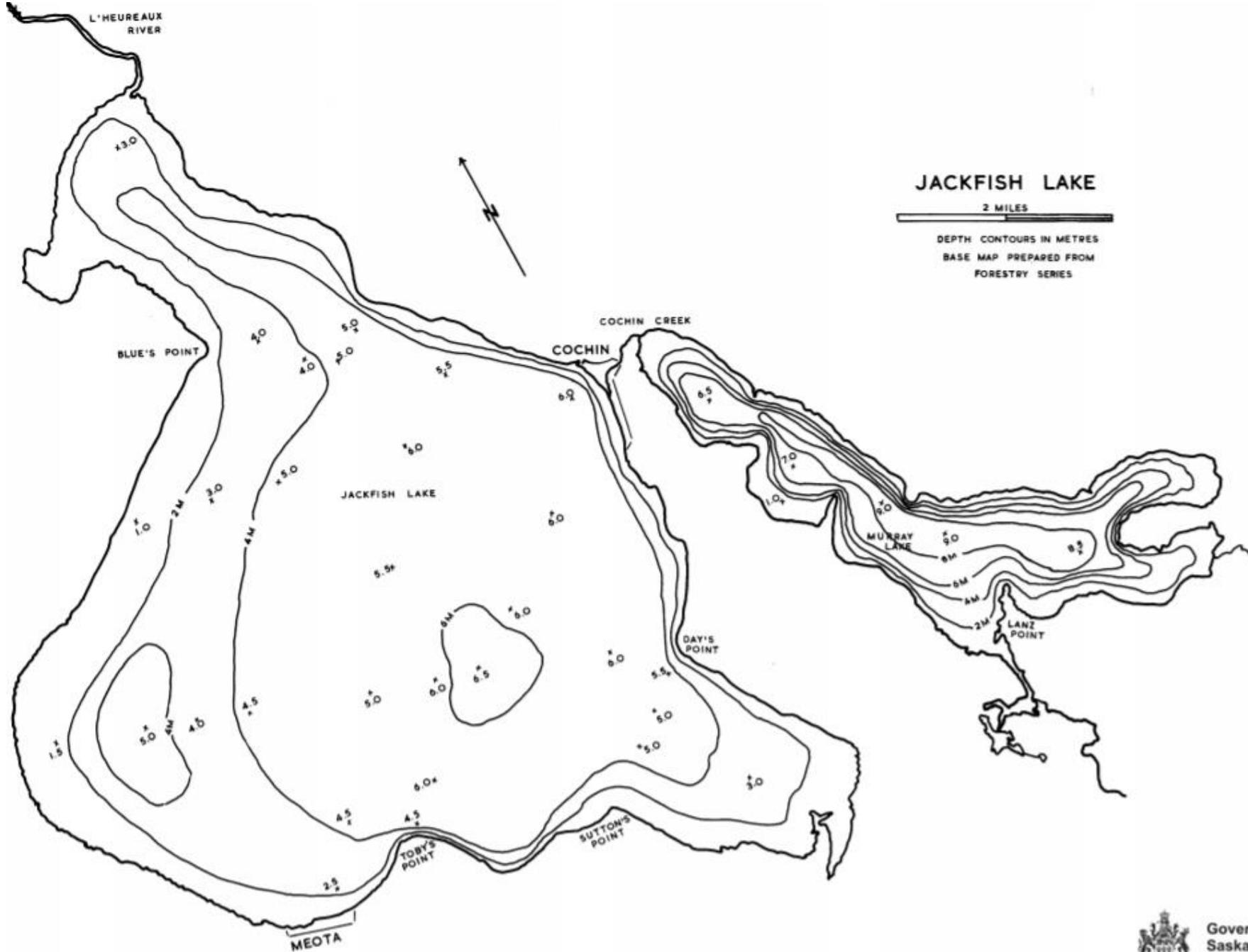
Data Sources:
- Data provided by Bing, Heritage Conservation Branch

Project #: 4610.0003.02
 Author: AK
 Checked: DS
 Status: **DRAFT**
 Revision: A
 Date: 2021/1/28

URBAN SYSTEMS

FIGURE XX

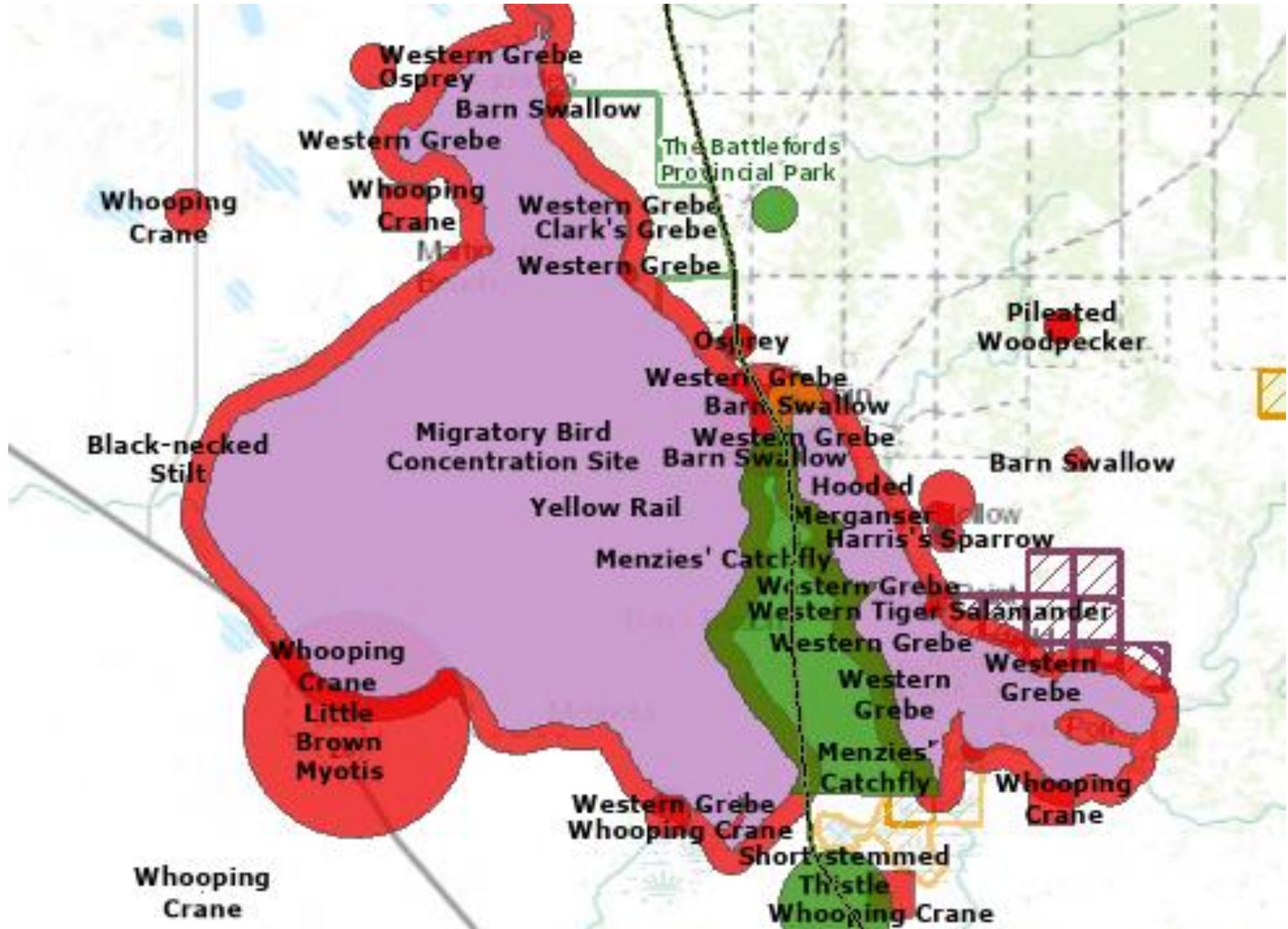
BATHYMETRIC MAPPING



Government of
Saskatchewan

NOT FOR NAVIGATION

SPECIES AT RISK



JACKFISH LAKE SHORELINE CAPABILITY



Rural Municipality of Meota
Jackfish Lake Development Study
Shoreline Capability Analysis

- Legend**
- Jackfish Lake
 - Lakeshore Development (100m Buffer)
 - Developed (45%)
 - Dispersed (5%)
 - Undeveloped (50%)

Notes:
- Development areas identified using Google Earth imagery, July 2021

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

0 500 1000 1500
Meters

Coordinate System:
NAD 1983 CSRS UTM Zone 13N

Scale:
1:29,500
(When plotted at
22"x34")

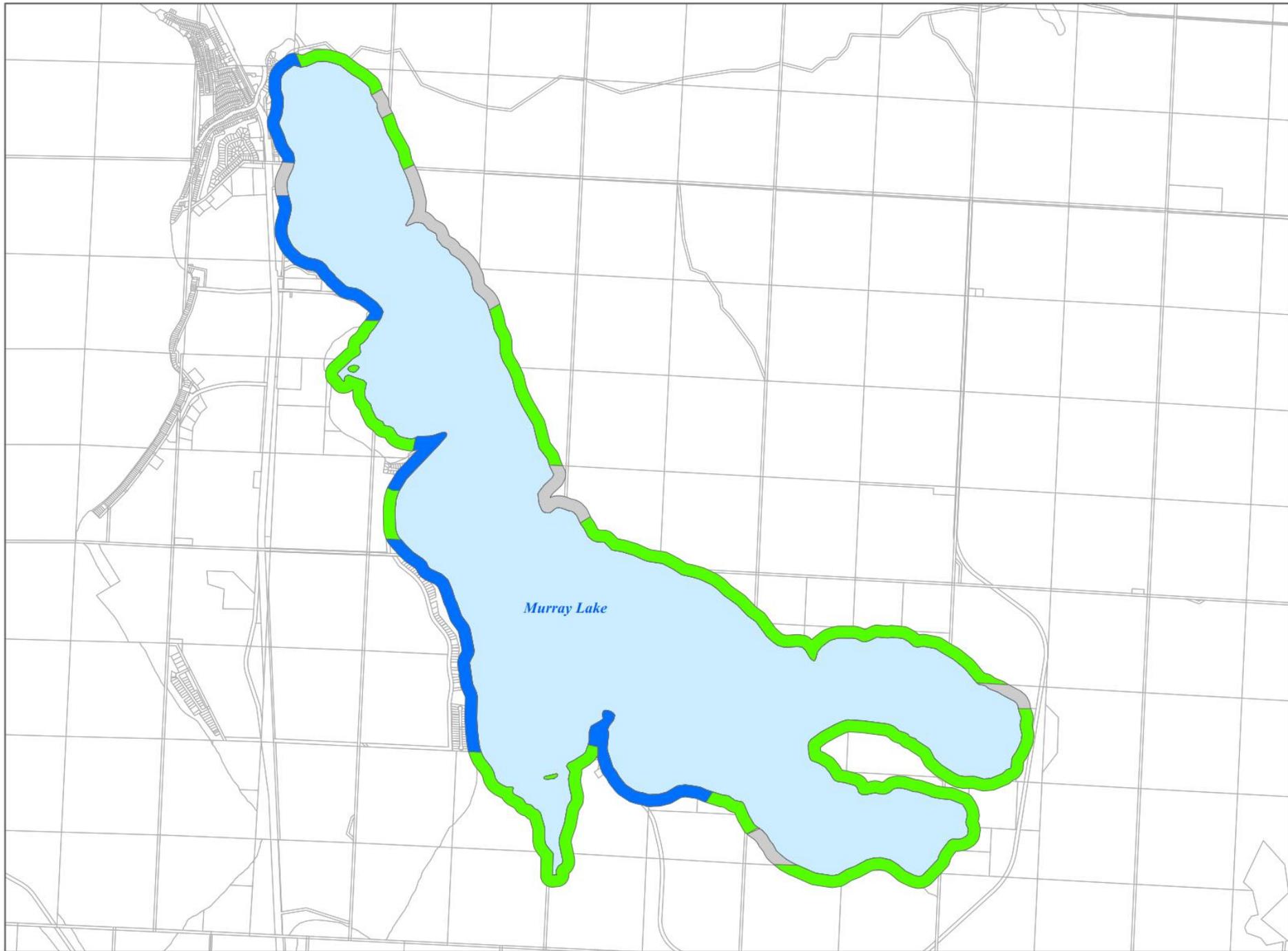
Data Sources:
- Data provided by Bing, Google Earth, Government of Saskatchewan, Canada Land Inventory

Project #: 4610.003.02
Author: SJA
Checked: DC
Status: **DRAFT**
Date: 2021/7/15

URBAN
SYSTEMS

FIGURE XX

MURRAY LAKE SHORELINE CAPABILITY



Rural Municipality of Meota
Murray Lake Development Study
Shoreline Capability Analysis

- Legend**
- Murray Lake
 - Lakeshore Development (100m Buffer)
 - Developed (24%)
 - Dispersed Development (12%)
 - Undeveloped (64%)

Notes:
- Development areas identified using Google Earth Imagery, July 2021

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.



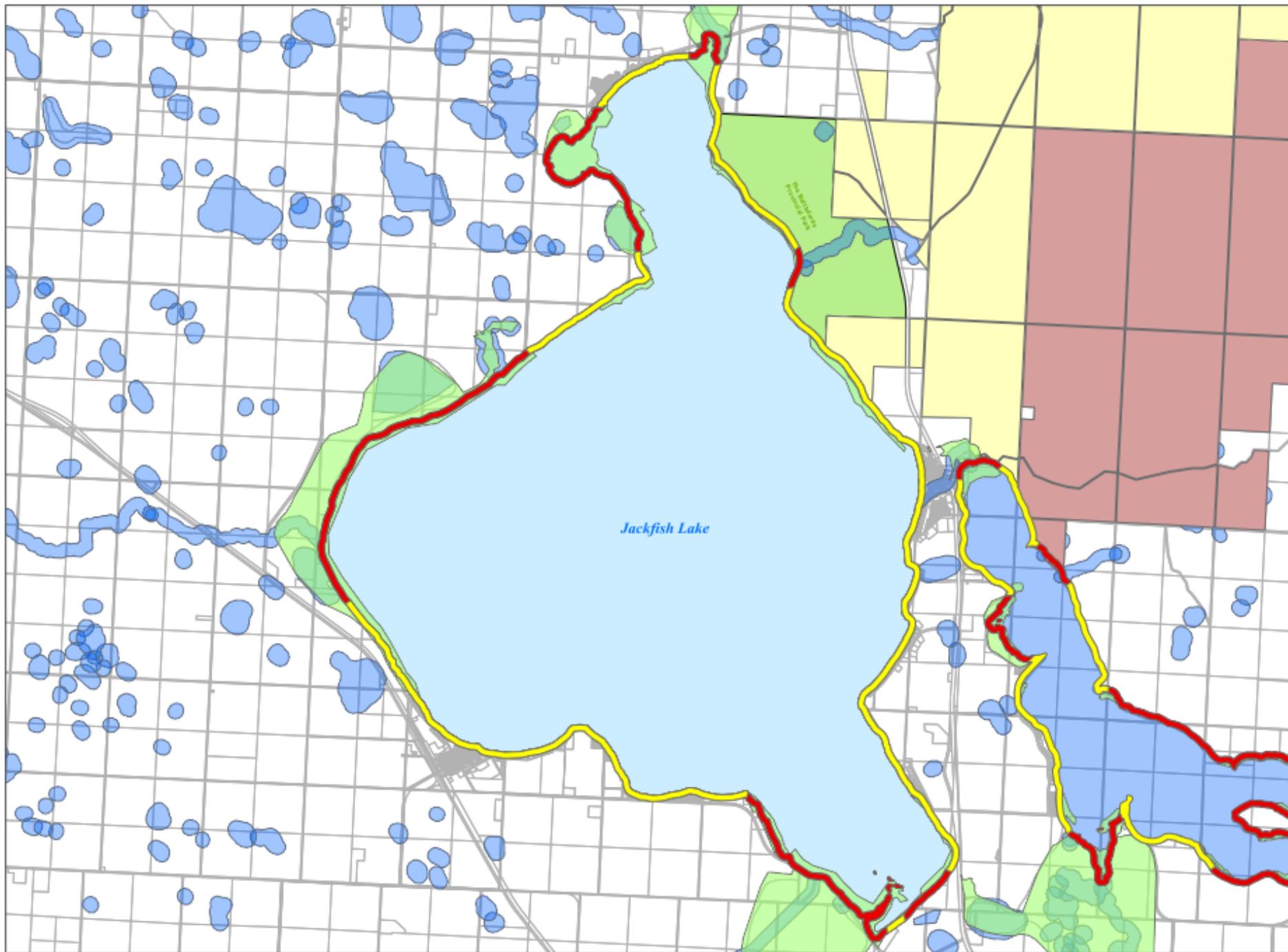
Coordinate System:
NAD 1983 CSRS UTM Zone 13N
Scale: 1:15,079
(When plotted at 22"x34")

Data Sources:
- Data provided by Bing, Google Earth, Government of Saskatchewan, Canada Land Inventory

Project #: 4610.003.02
Author: SJA
Checked: DG
Status: **DRAFT**
Date: 2021 / 7 / 15

URBAN SYSTEMS
FIGURE XX

JACKFISH LAKE ENVIRONMENTAL SENSITIVITY



Rural Municipality of Meota
 Jackfish Lake Development Study
 Environmental Sensitivity
 Analysis

- Legend**
- Jackfish Lake
 - Battledors Provincial Park
 - Moosomin First Nation
 - Saulekas First Nation
 - Streams and Waterbodies (100m Buffer)
 - Wetland/Emergent Vegetation
 - Potential for Environmental Impact**
 - Moderate (62%)
 - High (38%)

Notes:
 - Sensitive areas identified using slope layers, Google Earth imagery, and water body/stream buffers and site visits

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the precise location of all existing information whether shown or not.

0 500 1000 1500
 Meters

Coordinate System: NAD 1983 CRS UTM Zone 12N
 Scale: 1:20,000
 (When plotted at 22"x34")

Data Source:
 - Data provided by Bing, Google Earth, Government of Saskatchewan, Canada Land Inventory

Project #: 460.003.02
 Author: ISA
 Checked: DG
 Status: **FINAL**
 Date: 2021/8/27

URBAN SYSTEMS

FIGURE XX

LEHMAN'S CREEK ENVIRONMENTAL SENSITIVITY



Rural Municipality of Meota
 Lehman's Creek Development
 Study
**Environmental Sensitivity
 Analysis**

- Legend**
- Lehman's Creek
 - Wetland/Emergent Vegetation
 - #Potential for Environmental Impact**
 - Moderate (66%)
 - High (34%)

Notes:
 - Sensitive areas identified using slope layers, Google Earth Imagery, and water body/stream buffers and site visits.

The accuracy & completeness of information shown on this drawing is not guaranteed. It will be the responsibility of the user of the information shown on this drawing to locate & establish the ground location of all existing information at which shown on this

0 50 100 150
 Meters

Coordinate System: NAD 1983 CRS - UTM Zone 12N
Scale: 1:2000
 (when plotted at 20x34")

Data Sources:
 - Data provided by Bing, Google Earth, Government of Saskatchewan, Cirsula Land Inventory

Project #: 4610.0001.02
Author: DGA
Checked: DCG
Status: FINAL
Revision: A
Date: 2023/07/27

**URBAN
 SYSTEMS**

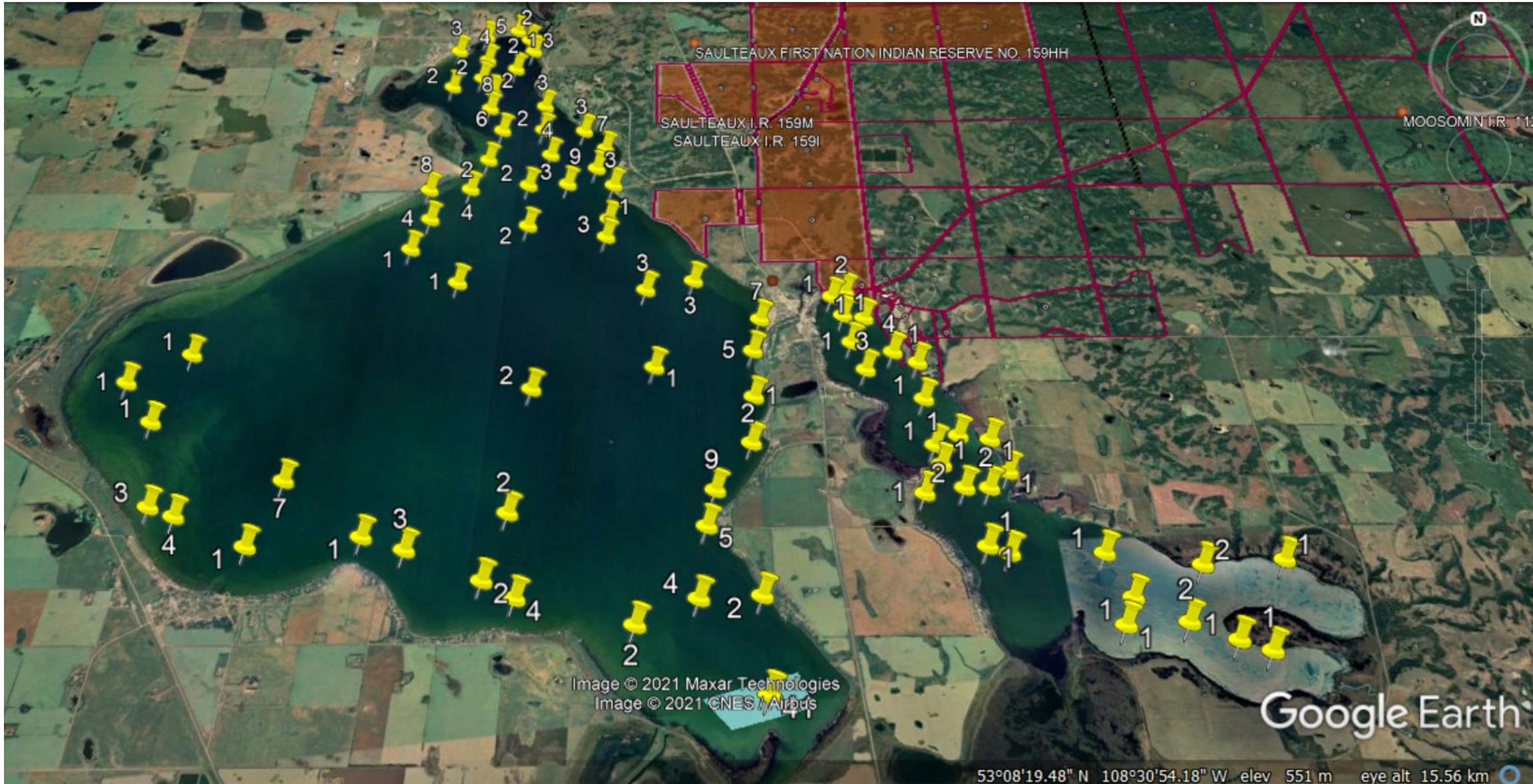
FIGURE XX

STATIC BOAT TYPOLOGIES ON THE LAKES

STATIC BOAT COUNTS				
Typology	Jackfish Lake	Leman's Creek	Murray Lake	Totals
Boats on Shore	189	35	88	312
Pontoon	171	34	52	257
Wakeboard	100	21	21	142
Runabout	121	40	33	194
Sailboat	9	1	0	10
Personal Watercraft (seadoo)	188	21	39	248
Small Fishing Boat	63	19	26	108
Non-motorized (kayak, paddleboard, human-powered)	196	27	88	311
Empty Docks	148	32	49	229
Empty Boatlifts	74	14	29	117

COUNT TAKEN STARTING AT 1:00PM SATURDAY, JULY 31, 2021

BOAT USAGE ON THE LAKE



Jackfish Lake – 220 Boats

Murray Lake – 36 Boats

WATER QUALITY – WINTER 2021

JANURAY

Parameter	Jackfish Lake	Murray Lake
TSS*		
Chlorophyll a*		
Secchi depth*		
Chloride	↓	↓
Ammonia	↑	↑
Nitrate	↔	↑
Nitrite*		
Organic Nitrogen	↓	↓
Total Nitrogen	↓	↔
Trophic Status*	Nutrient rich	Highly nutrient rich
Faecal micro-organisms	↔	↔
Dissolved Oxygen*		
Temperature*		

MARCH

Parameter	Jackfish Lake	Murray Lake
TSS*	↔	↔
Chlorophyll a*	↑	↑
Secchi depth*	↑	↓
Chloride	↓	↓
Ammonia	↑	↓
Nitrate	↔	↑
Nitrite*	↔	↔
Organic Nitrogen	↓	↔
Total Nitrogen	↔	↔
Trophic Status*	↔	↑
Faecal micro-organisms	↔	↔
Dissolved Oxygen*	↓	↓
Temperature*	↔	↔

Notes:

*	Uses 2021 data only
↑	Increasing trend
↔	No increase or decrease
↓	Decreasing trend
	Within guideline criterion
	Exceeds guideline criterion
	No guidelines apply



WATER QUALITY – SUMMER 2021

MAY

Parameter	Jackfish Lake	Murray Lake
TSS*	↑	↑
Chlorophyll a*	↑	↑
Secchi depth*	↓	↓
Chloride	↓	↓
Ammonia	↑	↔
Nitrate	↔	↔
Nitrite*	↔	↔
Organic Nitrogen	↓	↓
Total Nitrogen	↓	↓
Trophic Status*	↔	↓
Faecal micro-organisms	↔	↔
Dissolved Oxygen*	↑	↑
Temperature*	↑	↑

JULY

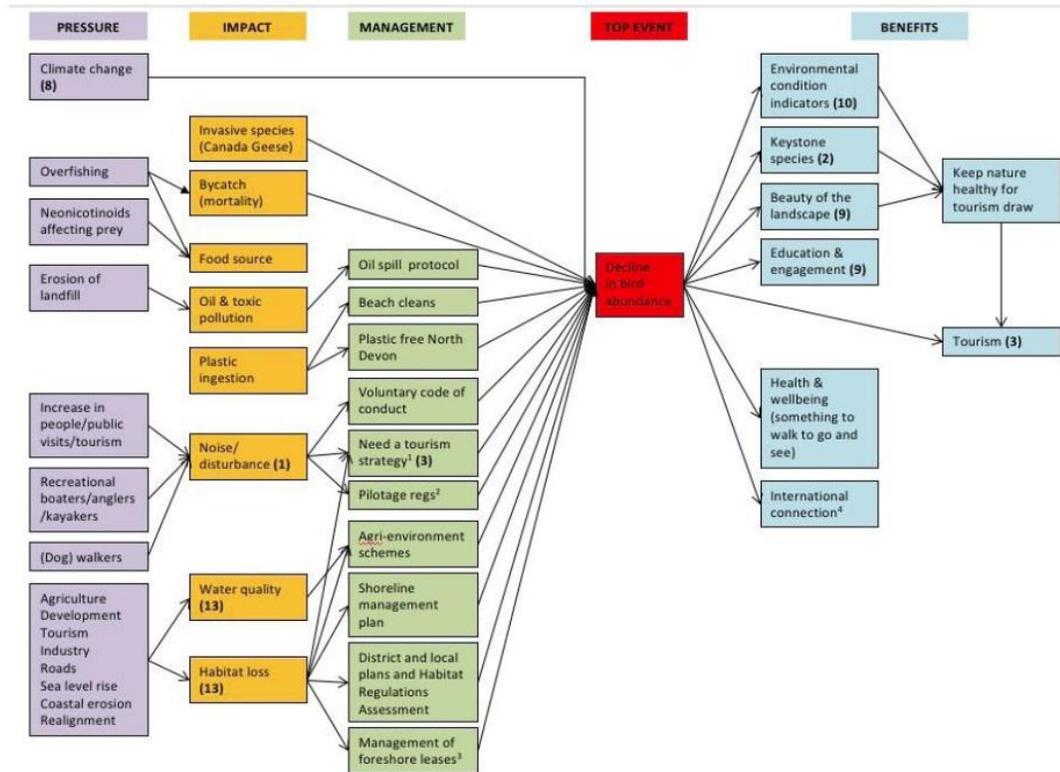
Parameter	Jackfish Lake	Murray Lake
TSS*	↑	↑
Chlorophyll a*	↔	↑
Secchi depth*	↓	↑
Chloride	↓	↓
Ammonia	↓	↔
Nitrate	↔	↔
Nitrite*	↔	↔
Organic Nitrogen	↓	↔
Total Nitrogen	↓	↔
Trophic Status*	↓	↓
Faecal micro-organisms	↔	↔
Dissolved Oxygen*	↑	↑
Temperature*	↑	↑

Notes:

*	Uses 2021 data only
↑	Increasing trend
↔	No increase or decrease
↓	Decreasing trend
Green background	Within guideline criterion
Red background	Exceeds guideline criterion
Grey background	No guidelines apply



CUMULATIVE EFFECTS



Canadian Environmental Assessment Agency defines this as:

Changes to the environment that are caused by an action in combination with other past, present and future human actions.

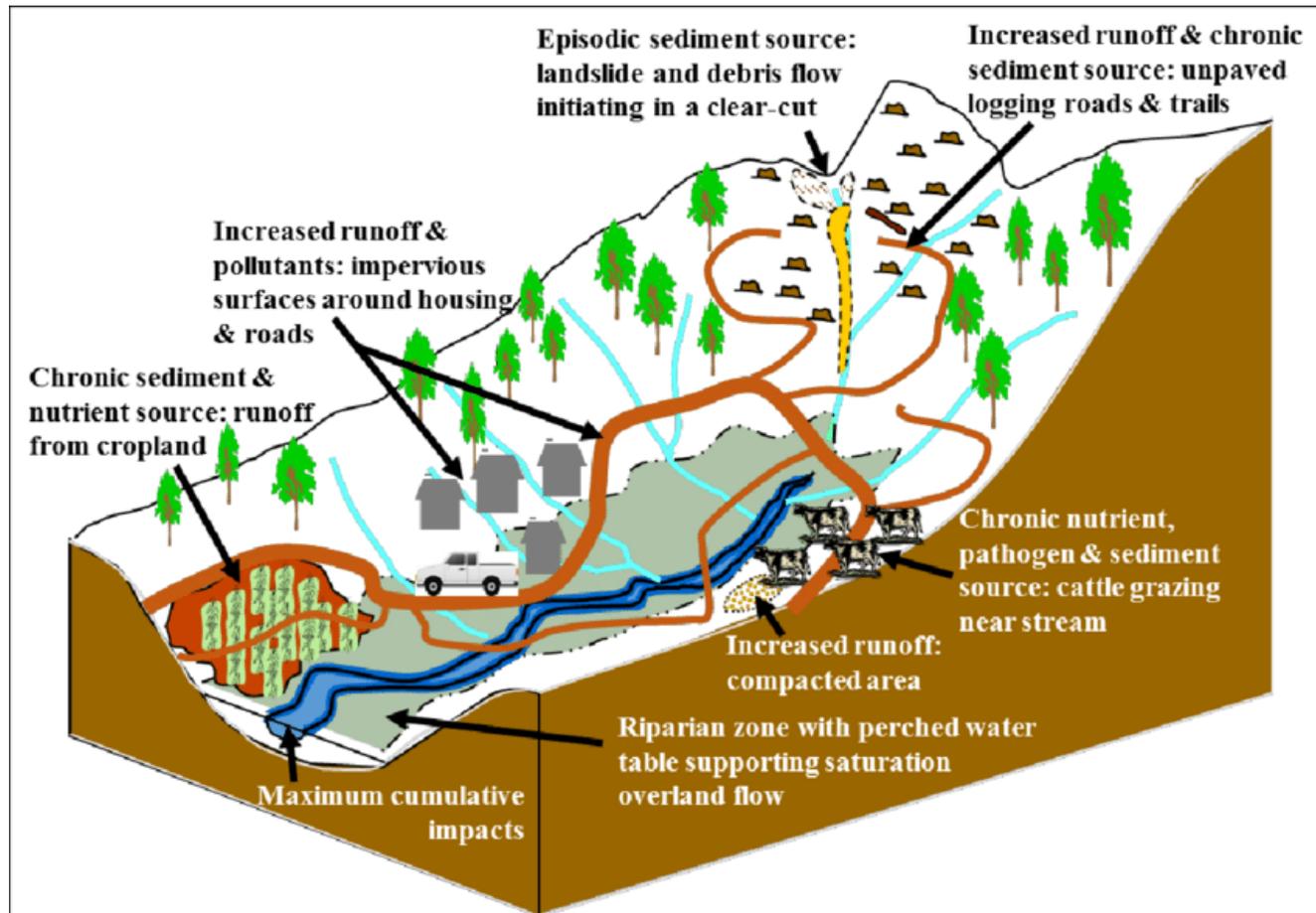
US Council on Environmental Quality define this as:

Incremental impact of a proposed action when added to other past, present and reasonably foreseeable actions.

Example of the graphical structure of a bowtie analysis



CUMULATIVE EFFECTS



Water quality, fish habitat, wildlife habitat, soils, vegetation, air quality

Boating – disturbance from motors, release of oils/gas/lubricants

Aquatic vegetation (weed) removal – loss of habitat (spawning), uptake of nutrients, filtering pollutants, food sources for wildlife (including invertebrates, amphibians)

Sediment release – runoff from exposed soils (loss of material, release of contaminants, impacts to fish habitat)

Release of sewage (raw and treated)

Release of chemicals – lawn care, weed management, accidental spills not cleaned appropriately or reported

Vegetation also provides stability to riparian areas, the lake

Transport of aquatic

Erosion

Upstream or adjacent land uses – runoff from agriculture, industry



LAKE CLASSIFICATION

The Lake Classification System includes the following classes of lakes – each with their own definition, criteria (including exceptions), and management guidelines:

- **Agricultural Lakes** – have a substantial amount of farming, grazing or ranching activities around the shore zone and usually surrounded by large parcels of land;
- **Natural Environment Lakes** – Lakes with high aesthetic qualities, recreation values and significant wildlife populations. Usually small and away from populated areas and limited development.
- **Development Lakes** - those lakes that can withstand a variety of uses including extensive public recreation and private development;
- **Limited Development lakes** – based on size and existing development patterns are only able to accommodate a limited amount of development. To maintain most of the undeveloped lakeshore areas which are necessary to sustain existing environmentally sensitive areas and wildlife habitat
- **Special Case Lakes** – Characterized by a mix of different land use with a significant amount of residential development with important recreational, ecological, cultural areas that need protection.



LAKE CLASSIFICATION

Jackfish Lake and Murray Lakes are classified as a Special Case Lakes

While each lake meets the criteria of a Development Lake, the following considerations results in their Special Case Lake classification:

- Federal recognition of Murray Lake as a Migratory Bird Sanctuary.
- Both Jackfish Lake and Murray Lake are within a Whooping Crane migratory route.
- The extent of significant habitat of the lakes, their tributaries and fringed wetlands.



MITIGATIVE MEASURES (NEW DEVELOPMENT)

- Pre-development, site specific ecological inventory/surveys
- Establish buffers/setback requirements and guidelines
 - Lakeshore
 - Watercourses/tributaries
 - Wetlands
 - Escarpments
 - Native grasslands
- Condition of construction policy
 - Environmental Construction Operation (ECO) plans
 - Erosion and sediment control plans
 - Stormwater management studies and design
- Design considerations
 - Identify wildlife corridors and migration routes, and sensitive habitat
 - Minimize removal of natural vegetation, avoid manicured landscapes and limit impervious surfaces
 - Identify potential for shared community infrastructure ie. water, wastewater, lake access
- Avoid removal of riparian and emergent vegetation for creation of beach areas and boat access
- Education and enforcement



MITIGATIVE MEASURES (RE-DEVELOPMENT)

- Review and update development permits to address appropriate environmental regulations (municipal, provincial and federal)
- Restrict stripping of vegetation to high water mark with site specific buffer
- Site inspections and monitoring during and post construction
- Improve waste management and disposal standards
- Ensure regulatory approvals, guidelines and BMP's are followed for any planned work within waterbodies.
- Education and enforcement



LAKE MANAGEMENT GUIDELINES

- Create development bylaws, permits, policies and directives (i.e.: tree protection, erosion and sediment control, watercourse/wetland protection)
- Promote sustainable practices through one stewardship group: i.e. awareness of sustainable practices, engage with community, establish/revisit goals/objectives annually, include students or educational institutions for resource and research support
- Establish collective development review body to review and approve development permits and new developments – combine economic and administrative resources
- Encourage compliance with existing provincial and federal legislation (i.e. Fisheries and Oceans measures to protect fish and fish habitat)
- Consider bans or limitations on the use of artificial grass and fertilizers/pesticides/herbicides, etc.
- Review post development guidelines and policy for effectiveness and compliance, and identify improvement
- Lake Accessibility (road/boat/land)– limit clearing or degradation of native vegetation by implementing collective public access and trail networks
- Restoration of compromised shorelines and qualifying setbacks to improve the lakes natural ability to improve water quality, fish habitat, and reduce flood risk and erosion
- Maintain undeveloped shorelines in a predominantly natural state
- Acknowledge and respect high water mark and wetland boundaries



LAKE MANAGEMENT GUIDELINES

- Develop mitigation measures and considerations for watershed protection. This could include collective initiatives to minimize or eliminate nutrient loading – direct and indirect sources such as agricultural runoff, sewage disposal, erosion and sedimentation
- Avoid development in areas susceptible to erodible soils and steep slopes
- Retain/restore/conservate natural areas such as wetlands, rock outcrops, bluffs, tributaries, valuable fish habitat areas and any other ecological significant areas
- Establish boating restrictions/conditions in sensitive areas
- Encourage improvements to existing agricultural land use - accessing NGO groups (i.e: Ducks Unlimited Canada) in support of fencing, cattle guards, off site watering troughs or other measures to mitigate land use conflicts and water quality impacts
- Education and enforcement

