



# The North Slope Decision Support System for Water Resources Planning and Management

Presented by:

Stephen Bourne ([sfbourne@pbsj.com](mailto:sfbourne@pbsj.com))

Kelly Brumbelow ([kbrumbelow@tamu.edu](mailto:kbrumbelow@tamu.edu))

ITS, Arctic Ice and Snow Roads  
March, 2010



# Presentation Overview

- **Introduction: Ice Roads for Oil & Gas Exploration**
- **Project Objectives, Team, Plan**
- **Solution Design Strategy**
- **Proposed Solution**
- **Ice Road Planning**
- **The Role of Natural Systems**
- **Next Steps**

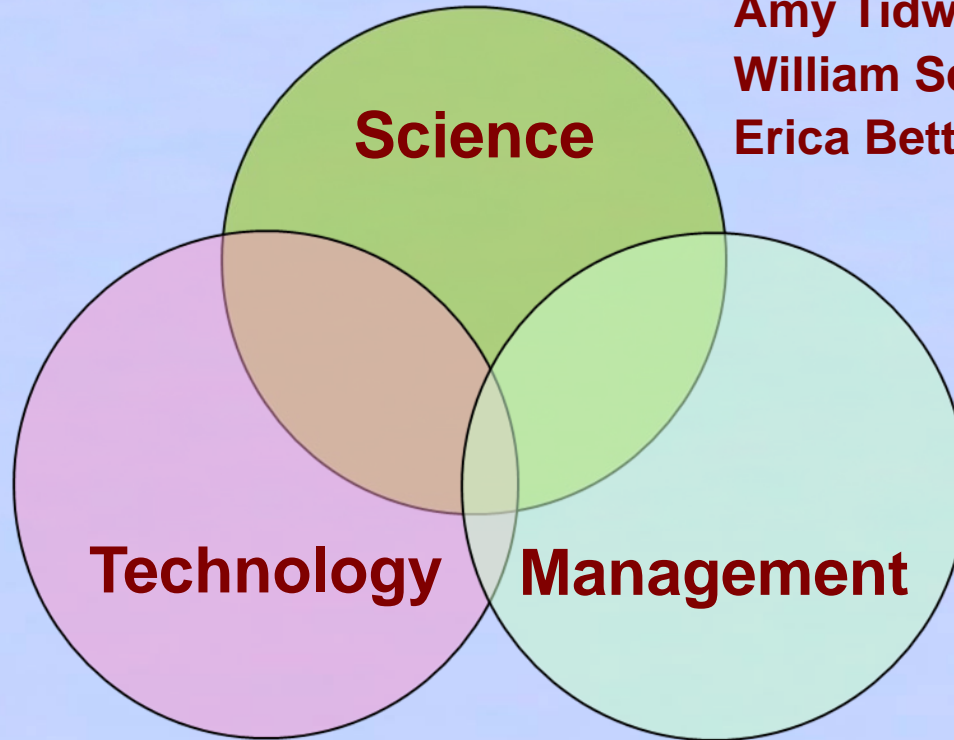


# Project Objectives

- **We intend to develop a water resources management solution in support of oil and gas exploration that explicitly considers:**
  - Optimal water use,
  - Direct and cumulative environmental impacts, and
  - Multiple objectives and values among stakeholders
- **Solution will include:**
  - Information system
  - Decision support tools
  - Methods for facilitating stakeholder involvement in decision making processes



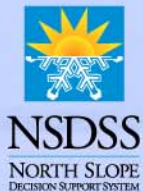
# Project Team



**Amy Tidwell, UAF**  
**William Schnabel, UAF**  
**Erica Betts, UAF**

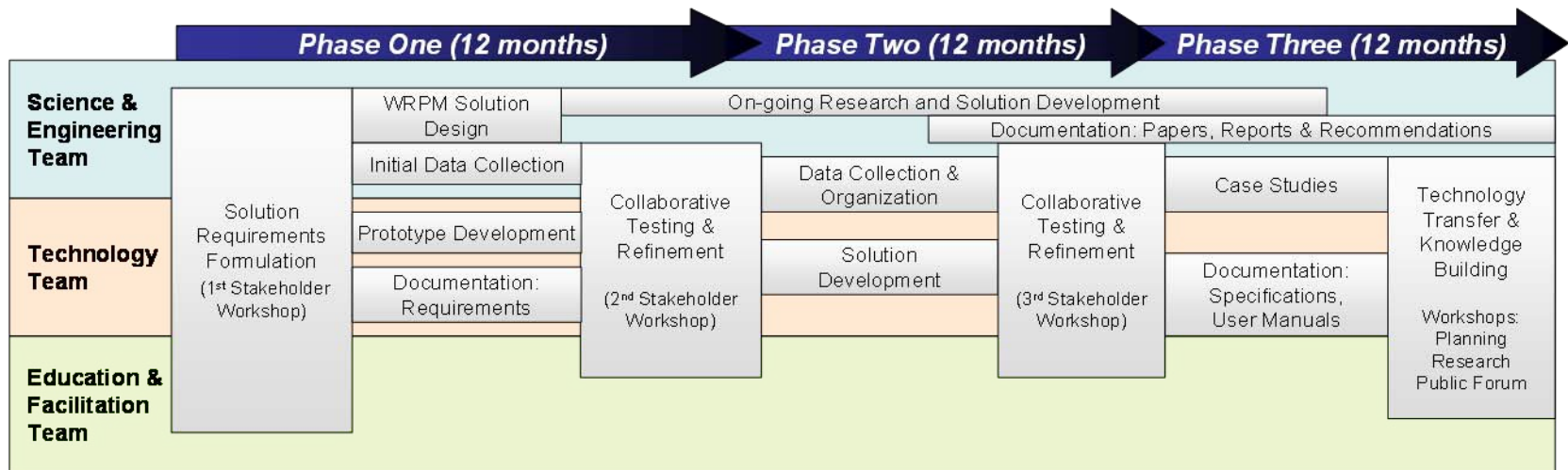
**Stephen Bourne, PBSJ**  
**Leslie Gowdich, PBSJ**  
**James Haleblan, Alcoloma**

**Kelly Brumbelow, TAMU**



# Project Plan

- Project will proceed in three one-year phases
  - **Phase I (Oct 2008 – Sep 2009)**  
Initial stakeholder input  
Rapid prototype development
  - **Phase II (Oct 2009 – Sep 2010)**  
Stakeholder collaborative testing & refinement  
Development of full-scale DSS
  - **Phase III (Oct 2010 – Sep 2011)**  
Technology transfer and knowledge building  
Application of full-scale system to case studies



# Solution Design Strategy

*The Optimist says the glass is half full,*

*The Pessimist says the glass is half empty,*

*The Engineer says the glass is twice as big as it  
needs to be...*

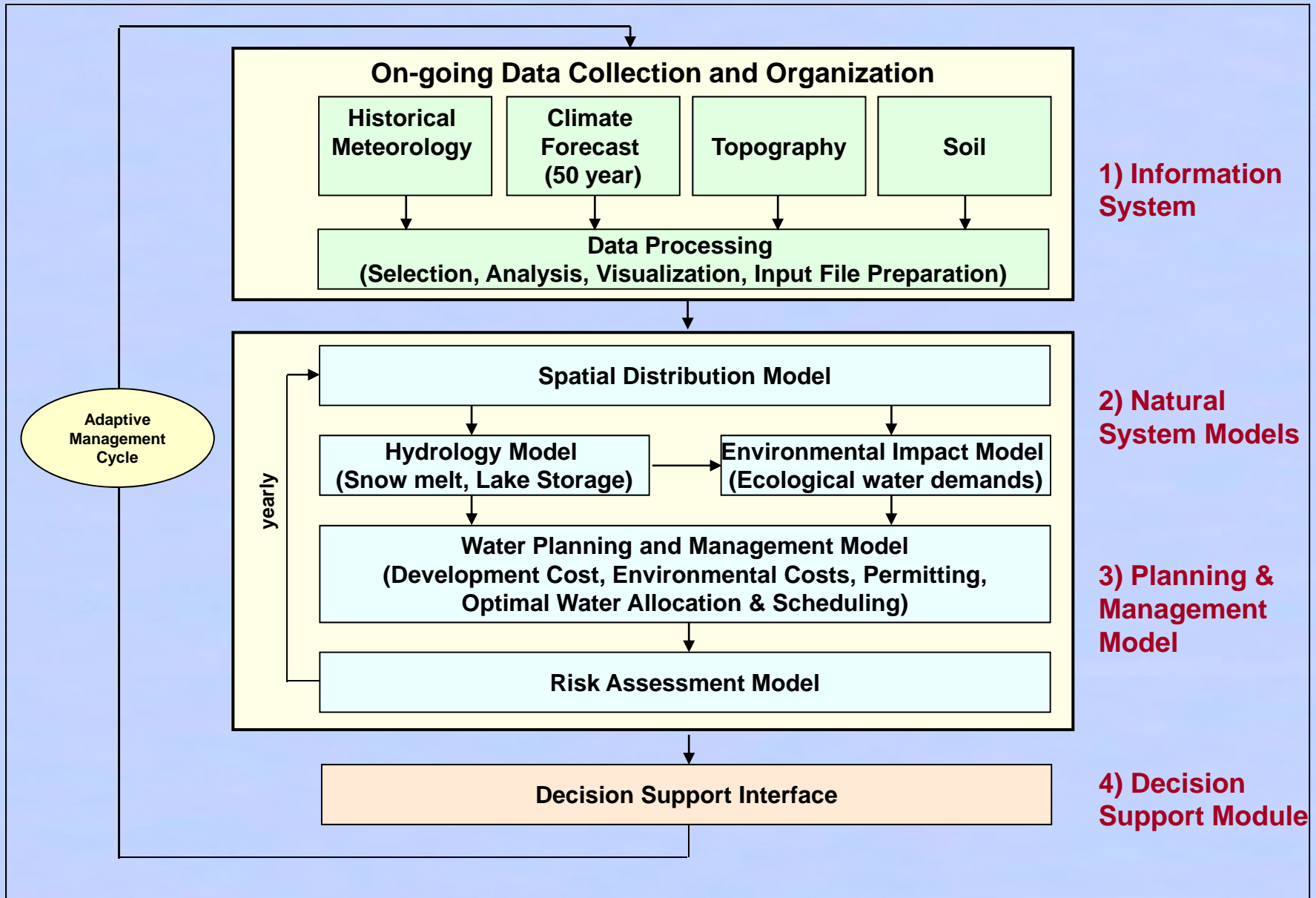
- **Include Stakeholders in the Design Process from the beginning**
- **Use existing data sources, research, technologies,**
- **Adopt existing/proven and standard methodologies**
- **Partner, Partner, Partner**



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# Proposed Solution: Schematic

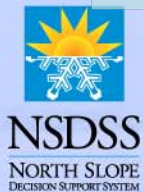
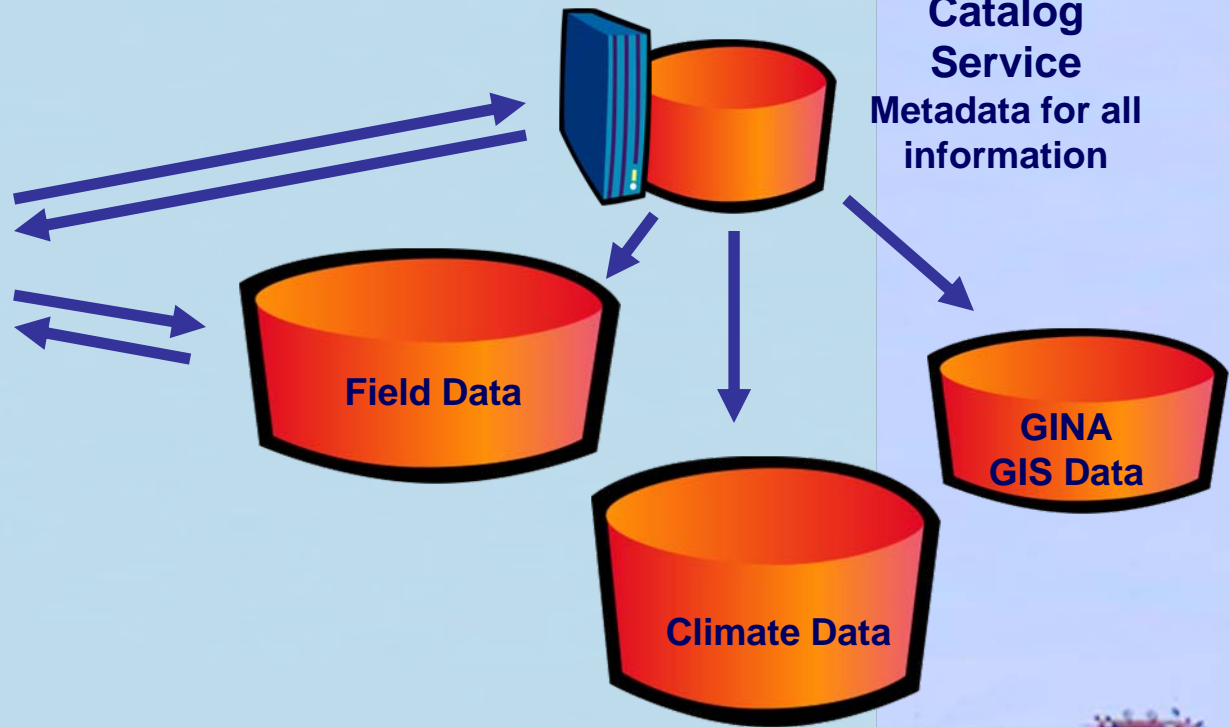
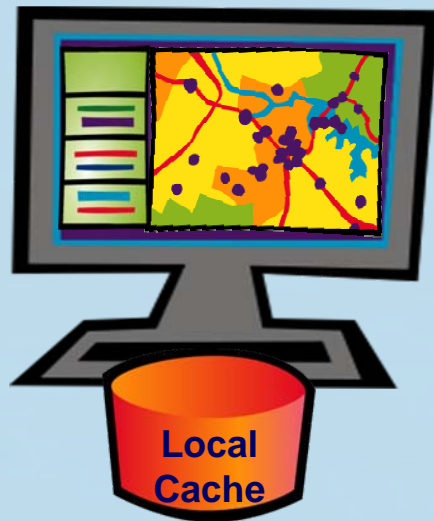


# Proposed Solution: Information Solution

**NorthSlopeDSS  
Workbench**  
GIS-based  
Desktop Tool

**CyberInfrastructure**  
Data, Tools, Reports

Catalog  
Service  
Metadata for all  
information

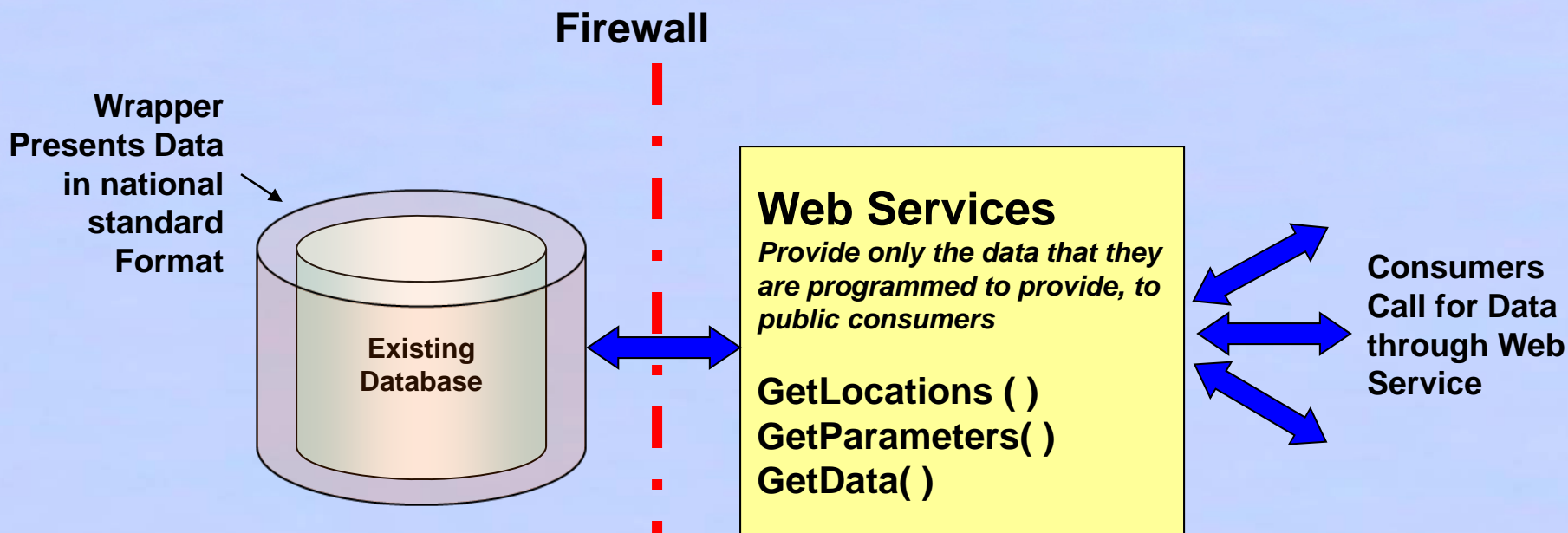




# Adding Existing Databases

## Database Wrapping and Web Services

*Achieving Standardization and Security in one Step*



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# Proposed Solution: Workbench

**NSDSS Workbench Software Tool is an ESRI ArcMap Extension. It enables exploration of data, analysis, and publication of findings through presenting common workflows for water resources analysis.**

**Workbench will contain multiple workflows and tools for analysis, which are published by the community and shared through the cyberinfrastructure.**

**Data within the workbench is stored in the statewide cyberinfrastructure, and is accessed directly by the workbench through web services.**

**Commonly cited websites and papers are geographically linked to areas of interest**

**City of Nuiqsut - North Slope Borough - Microsoft Internet Explorer**

**North Slope Borough**

**Villages**

- Saraw
- Anaktuvuk Pass
- Aqtouk
- Kaktovik
- Ikroavik
- Point Hope
- Point Lay
- Wainwright

**Contact**

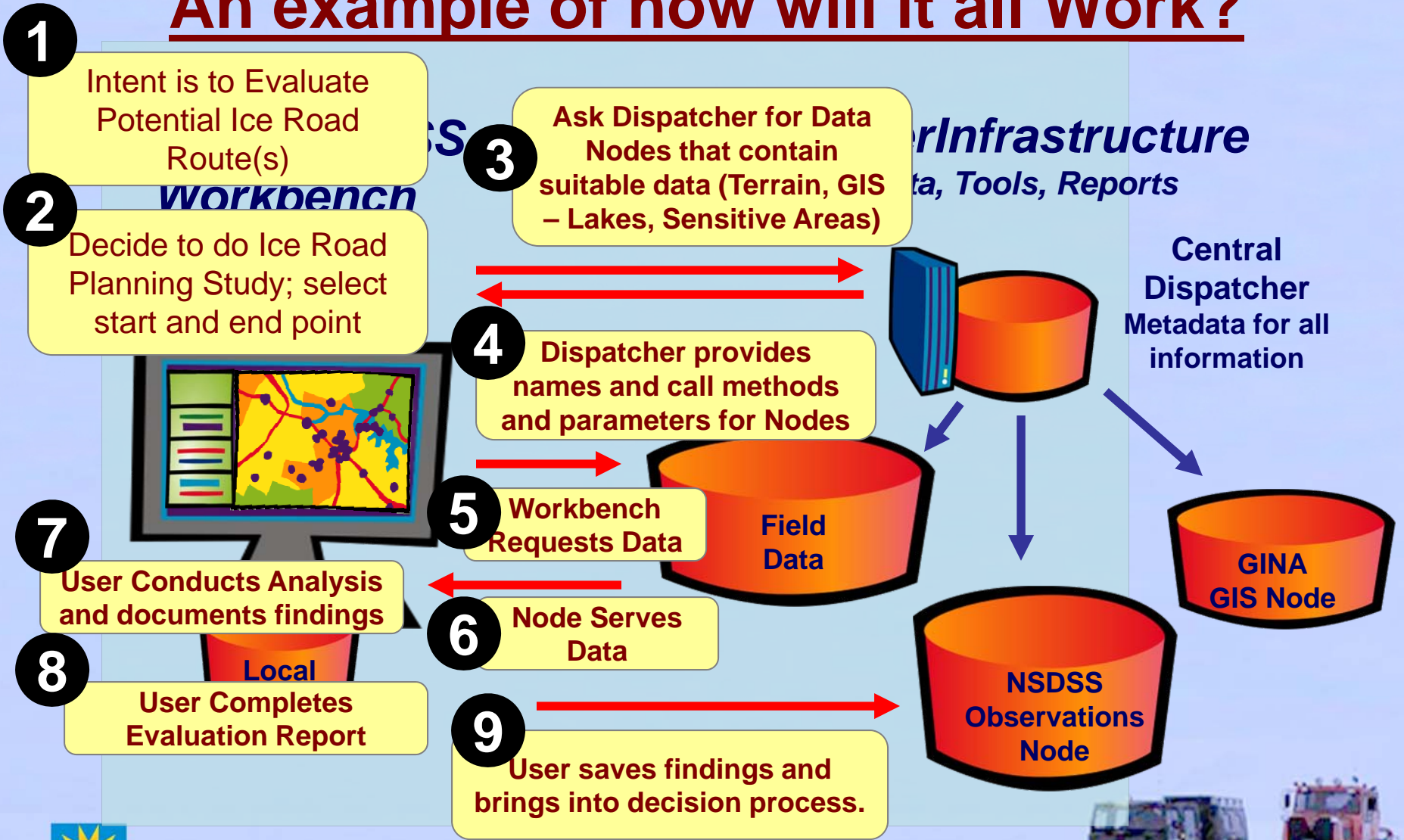
Saraw  
P.O. Box 629  
Saraw, AK 99723  
907.856.9211  
WWW

Anaktuvuk Pass  
P.O. Box 2100

**NUIQSUT**



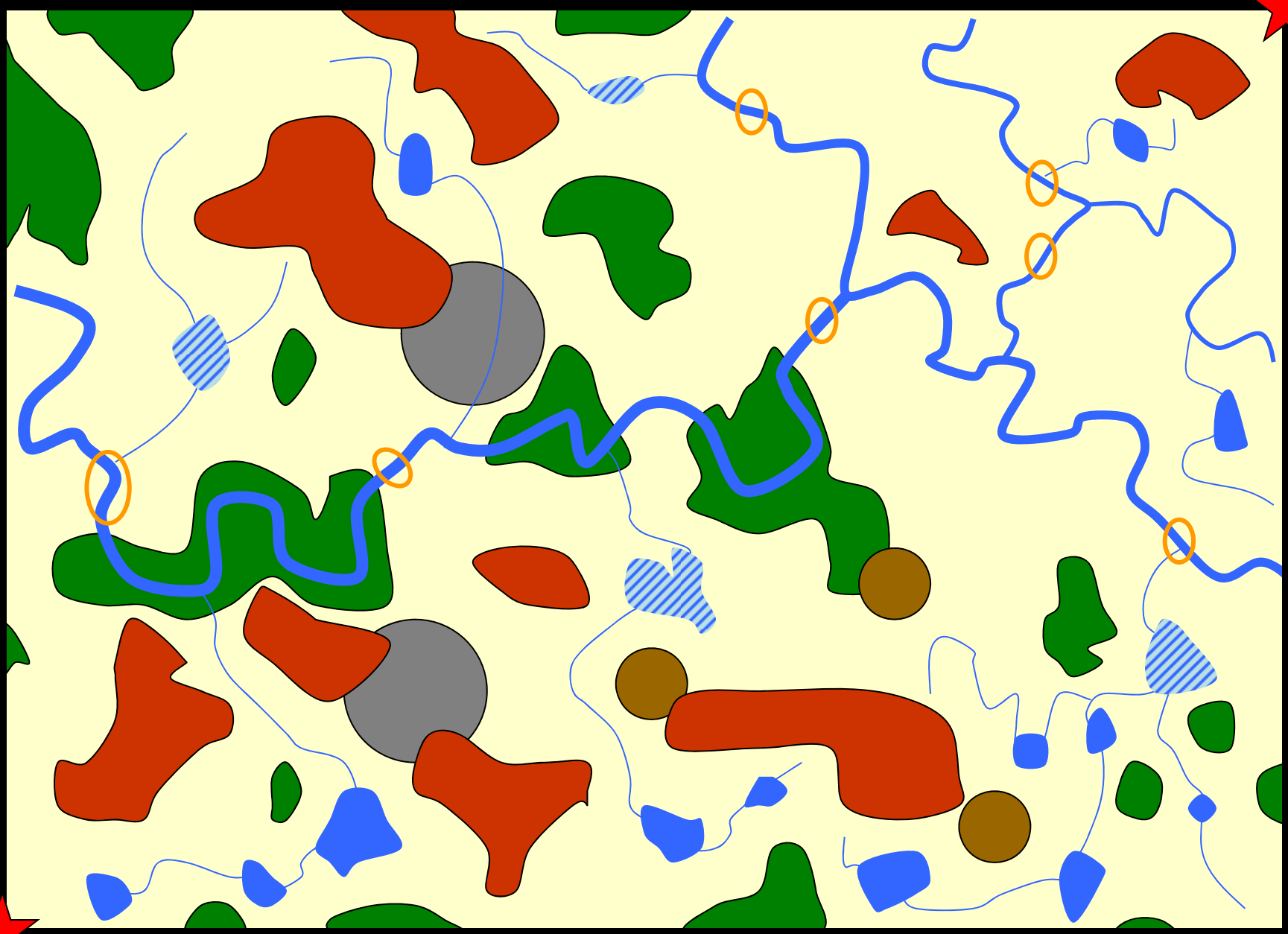
# An example of how will it all Work?



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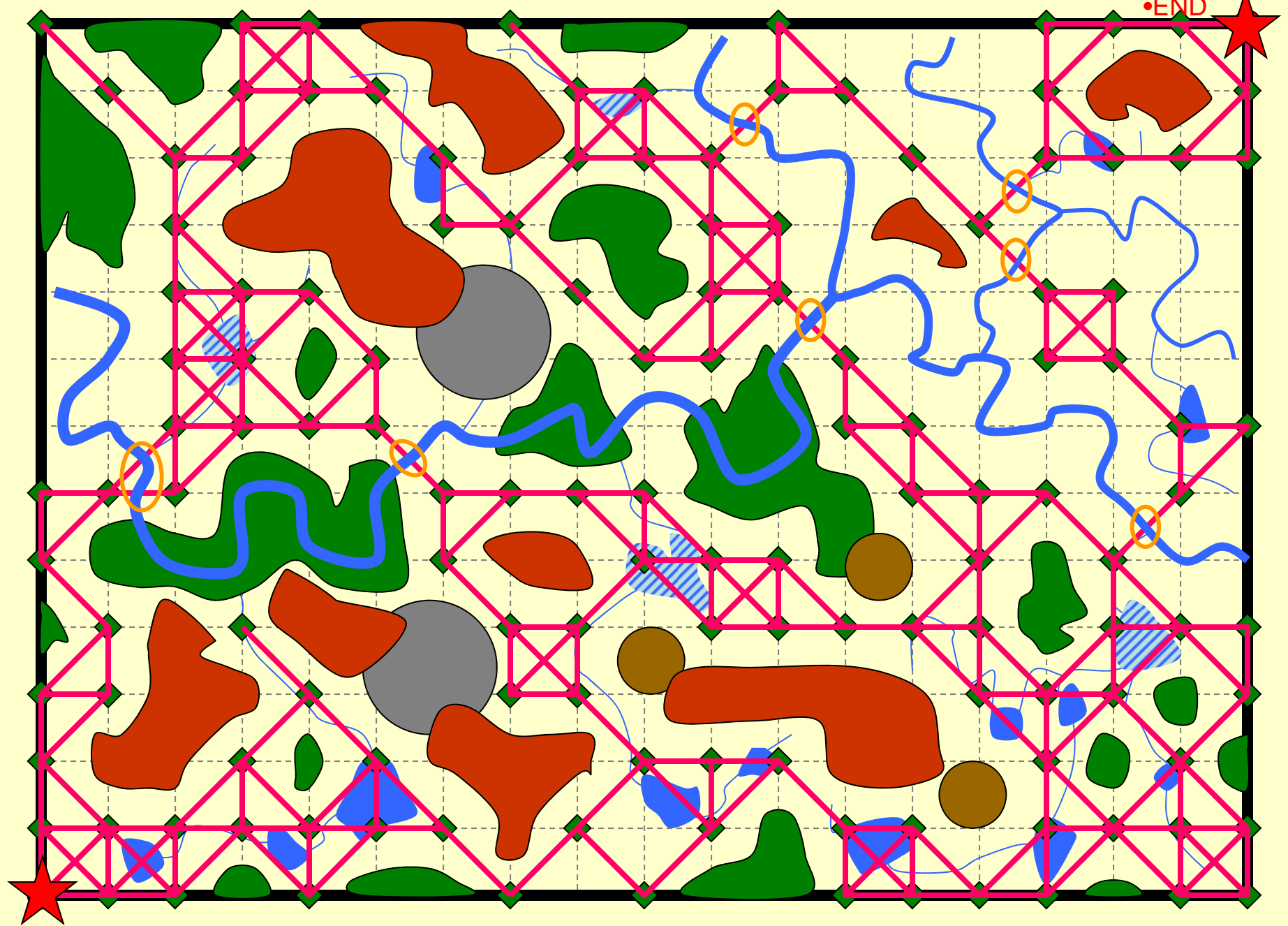
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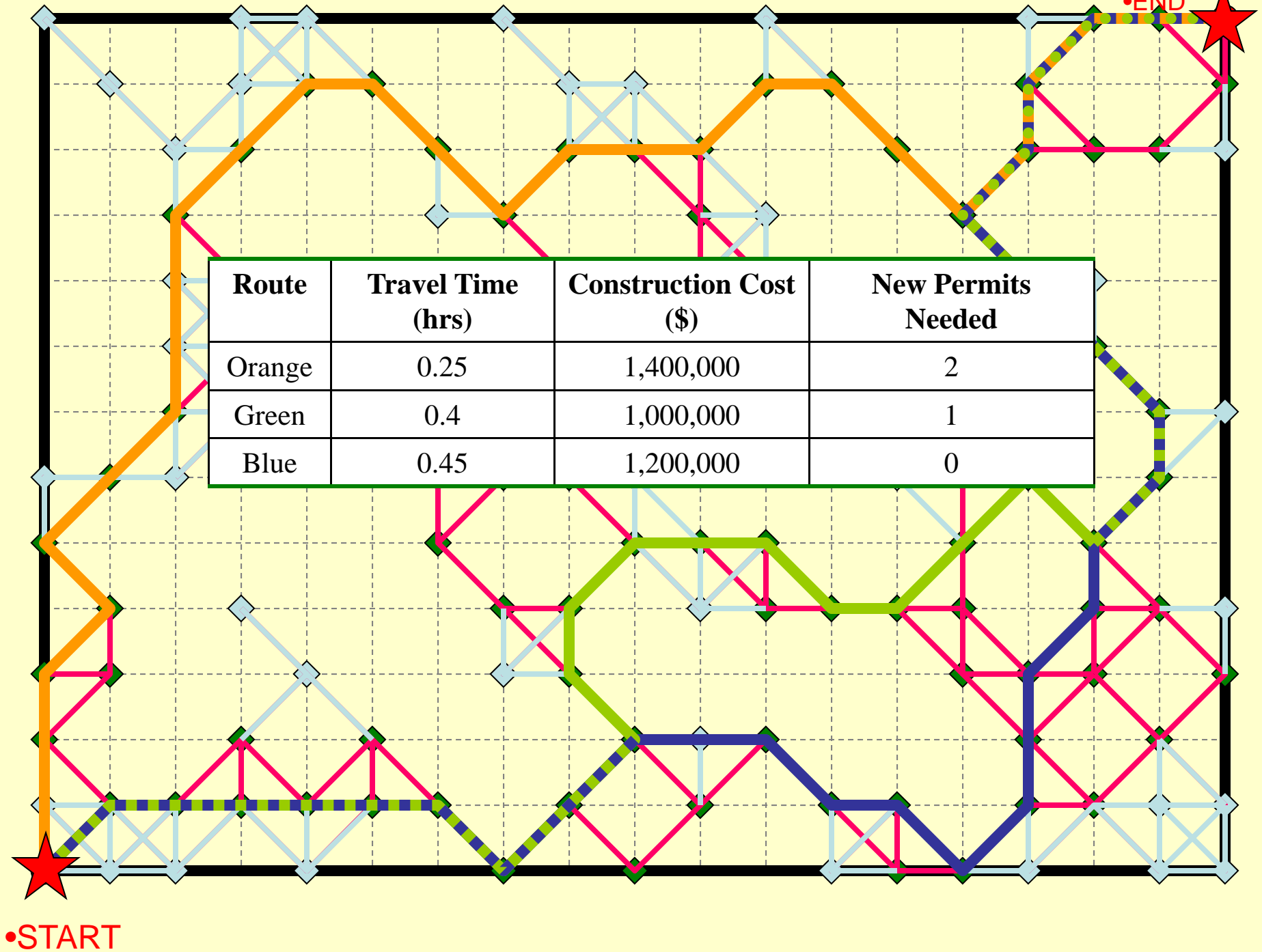


•START

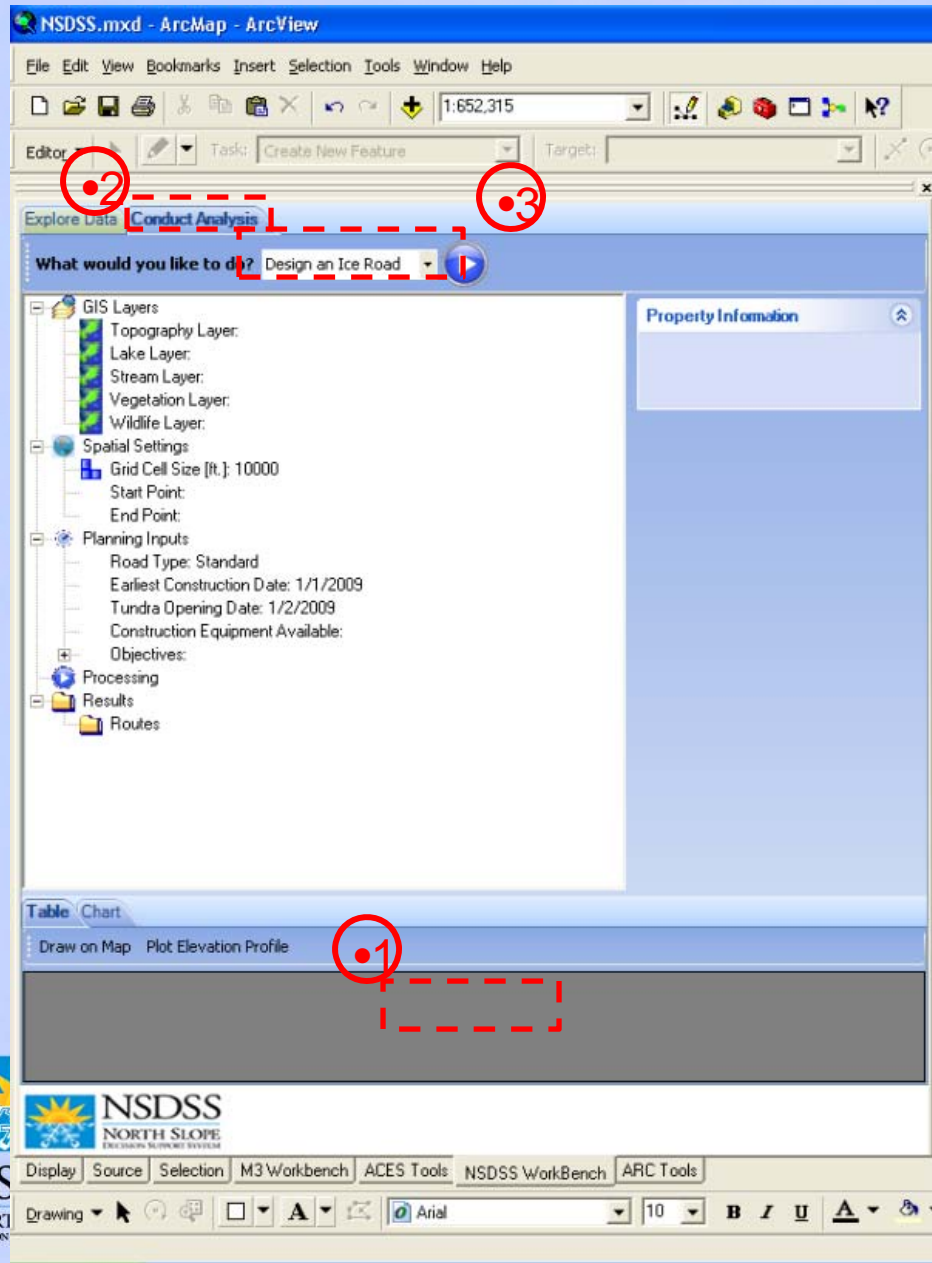
•START

•END





# Using the Ice Road Planning Workbench

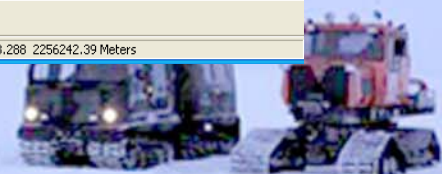
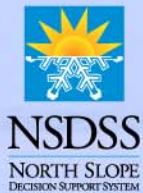


1. Click on NSDSS WorkBench tab in Table of Contents
2. Click on Conduct Analysis tab
3. Select Design an Ice Road from pull down menu and click Run (arrow)



# Set Start and End Point

The screenshot displays the ArcMap interface for the 'Design an Ice Road' tool. The 'Explore Data' pane on the left shows the tool's configuration, with a red dashed box highlighting the 'Spatial Settings' section. This section includes a 'Grid Cell Size (ft): 2000' and 'Start Point: 120157.980, 2258376.832' and 'End Point: 71314.431, 2242153.180'. The 'Property Information' pane on the right shows the '2000' value for the grid cell size. The main map area shows a topographic map of the North Slope of Alaska with various rivers and channels labeled, including the Kallik River, Tugmeachuk River, Fish Creek, Neshuk Channel, and others. A red dot labeled 'End' is placed on the map. The status bar at the bottom right indicates the coordinates '61568.288 2256242.39 Meters'.





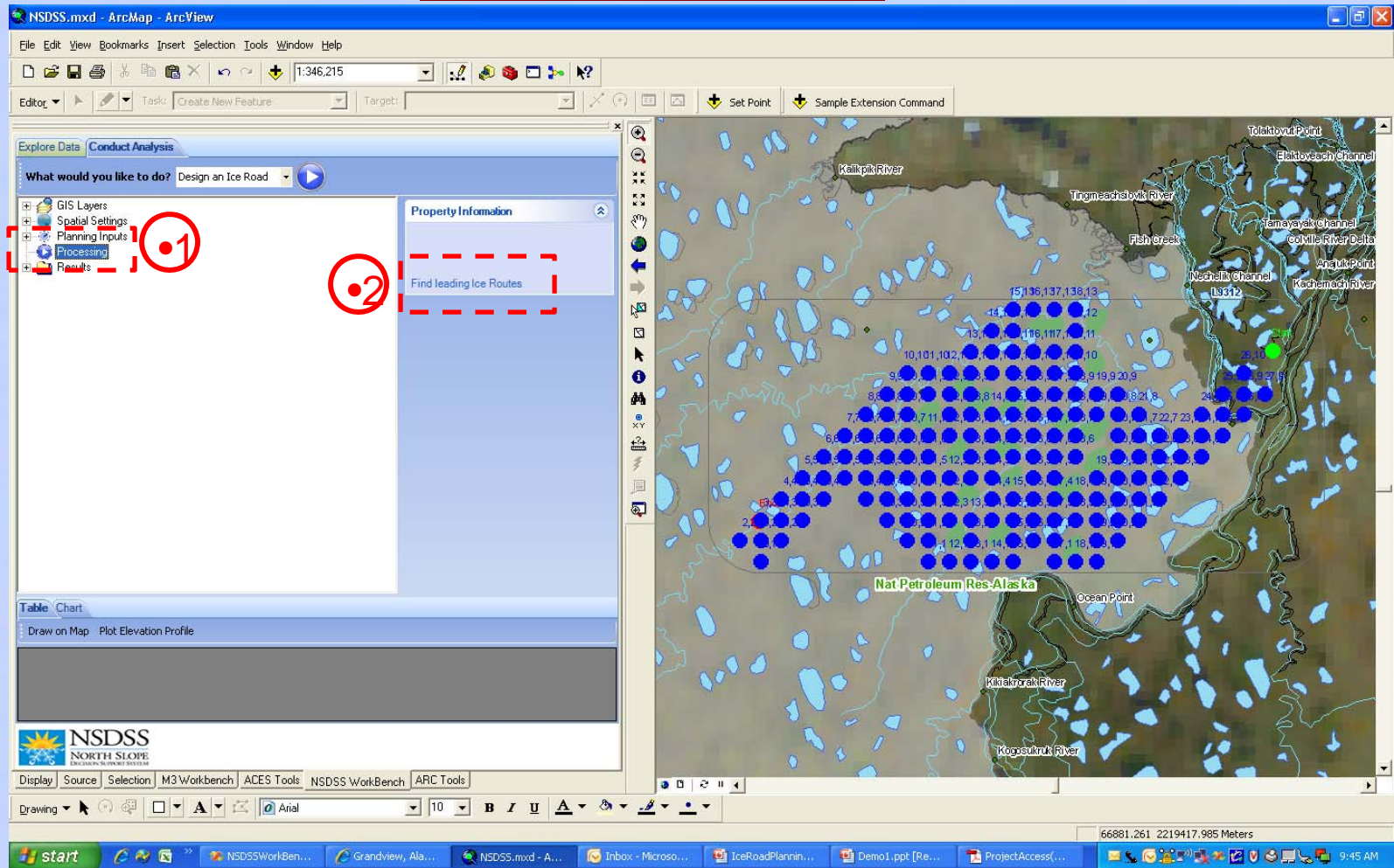
# Set Planning Inputs

The screenshot shows the 'Conduct Analysis' software interface. The main window has a title bar with 'Explore Data' and 'Conduct Analysis'. Below the title bar is a dropdown menu with 'Design an Ice Road' and a play button. The left sidebar contains a tree view with the following items: 'GIS Layers', 'Spatial Settings', 'Planning Inputs', 'Processing', and 'Results'. The 'Planning Inputs' folder is expanded, showing a list of parameters: 'Road Type: Standard', 'Earliest Construction Date: 1/1/2009', 'Tundra Opening Date: 1/2/2009', 'Construction Equipment Available:', and 'Objectives:'. Under 'Objectives:', three items are listed: 'TravelTime Monetization Factor (\$/Minutes): 1000000', 'ConstructionCost Monetization Factor (\$/Dollars): 1', and 'ConstructionDuration Monetization Factor (\$/Days): 15000'. The 'TravelTime Monetization Factor' is highlighted with a red circle '2'. A red dashed box encloses the 'Planning Inputs' section, with a red circle '1' next to it. On the right, the 'Property Information' window is open, showing a text input field with '1000000' and an 'Apply' button. A red circle '3' is next to the input field, and a red circle '4' is next to the 'Apply' button.

1. Expand Planning Inputs (click '+')
2. Expand Objectives (click '+') - Click on Travel Time Monetization Factor
3. Type desired input in Property Information window
4. Click Apply
5. Repeat for all Planning Inputs



# Run Processor



1. Click on Processing
2. Click on Find Leading Ice Routes in Property Information window



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# View Results & Discuss (Lakes)

NSDSS.mxd - ArcMap - ArcView

File Edit View Bookmarks Insert Selection Tools Window Help

1:279,363

Editor Create New Feature Target: Set Point Sample Extension Command

Explore Data Conduct Analysis

What would you like to do? Design an Ice Road

GIS Layers Spatial Settings Planning Inputs Processing Results

Property Information

Find leading Ice Routes

Table Chart

Draw on Map Plot Elevation Profile

	Number	Length	Total Cost [\$M]	TravelTime [Minutes]
<input checked="" type="checkbox"/>	Gen8_Route15	41	5,721	3
<input type="checkbox"/>	Gen10_Route1	41	5,796	3
<input type="checkbox"/>	Gen8_Route2	40	5,888	3
<input type="checkbox"/>	Gen9_Route20	41	5,901	3
<input type="checkbox"/>	Gen1_Route29	40	5,963	3
<input type="checkbox"/>	Gen5_Route4	42	5,999	3
<input type="checkbox"/>	Gen5_Route16	42	5,999	3
<input type="checkbox"/>	Gen5_Route20	43	6,004	3
<input type="checkbox"/>	Gen6_Route7	43	6,012	3
<input type="checkbox"/>	Gen2_Route20	43	6,012	3
<input type="checkbox"/>	Gen8_Route7	44	6,017	3
<input type="checkbox"/>	Gen10_Route2	42	6,051	3
<input type="checkbox"/>	Gen7_Route4	44	6,057	3

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ACES Tools NSDSS WorkBench ARC Tools

Display Source Selection M3 Workbench

Drawing Arial 10

66502.893 2251323.645 Meters

1. Select (check) route in Table
2. Lakes associated with route are highlighted in Red on the map





# The Role of Natural Systems

- What is the natural variability of net basin supply for a tundra watershed?
- How does net basin supply compare with potential water withdrawal?
- How will net basin supply change under future climate scenarios; what are the implications for future water supply?
- How will the tundra travel season change under future climate scenarios?
- How does winter water withdrawal affect tundra lake dissolved oxygen?



# Next Steps

## Implement Suggestions from Second Stakeholder Workshop

### Ice Road Planning – Interface & Data

- Remove/Clear for GIS Layers
- DEM – higher detail
- Higher Detail Lakes – from NHD
- Vegetation Layer
- Manually Draw Route to Assess Efficiency

### Ice Road Planning - Algorithm

- Allow range of start points (e.g. along a stretch of Dalton Hwy)
- Use Past Crossing Locations
- Assessment of Efficiency of Historic Routes
- Synthetic River Cross Section
- Work with Finer Detail Features (eg. Lakes)
- If Algorithm can't proceed, provide explanation
- Grid too coarse
- No valid routes

