

ESRI User Conference
July 17, 2014

Choosing the best route for Pipeline Construction

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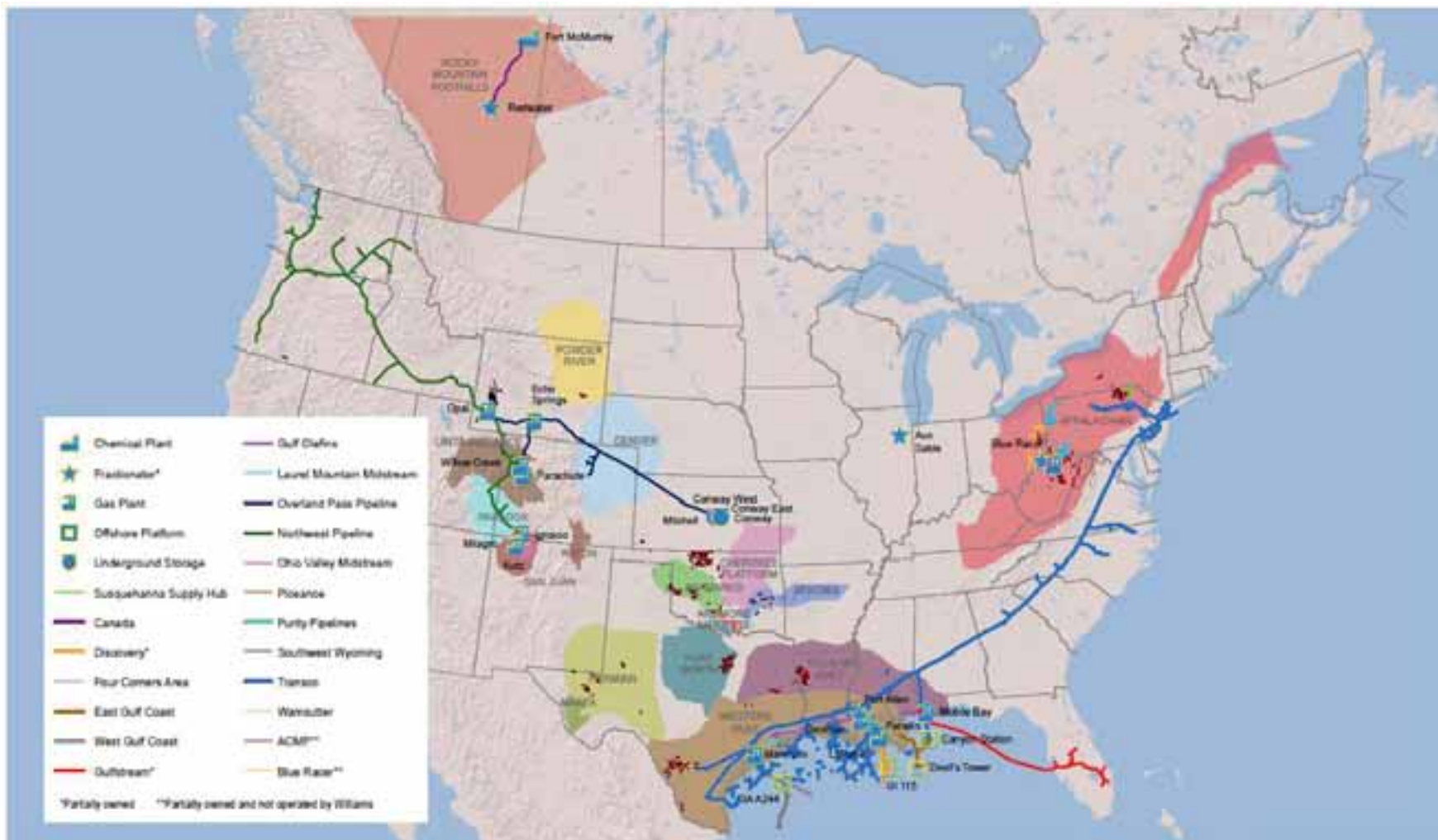


Who is *Williams*?

- > Fortune 500 Company
- > Energy Transportation
 - > Natural Gas
 - > Natural Gas Liquids (NGL)
 - > Methane, ethane, propane, butane
 - > Olefins – or alkenes – used to make common items like plastic shopping bags, milk jugs, plastic pipes, plastic vegetation barriers
- > Natural Gas Gathering & Processing
 - From the Well Head to the Burner Tip*
 - > Install and operate pipelines to gather gas at the well and move raw product to a facility for further processing
 - > Extract NGLs from rich gas
 - > Processed gas is burner-tip ready
- > Strong U.S. Presence
 - > Williams interstate pipelines transport approximately 14% of all U.S. natural gas – enough to serve some 30 million homes.



Williams Operations and Assets

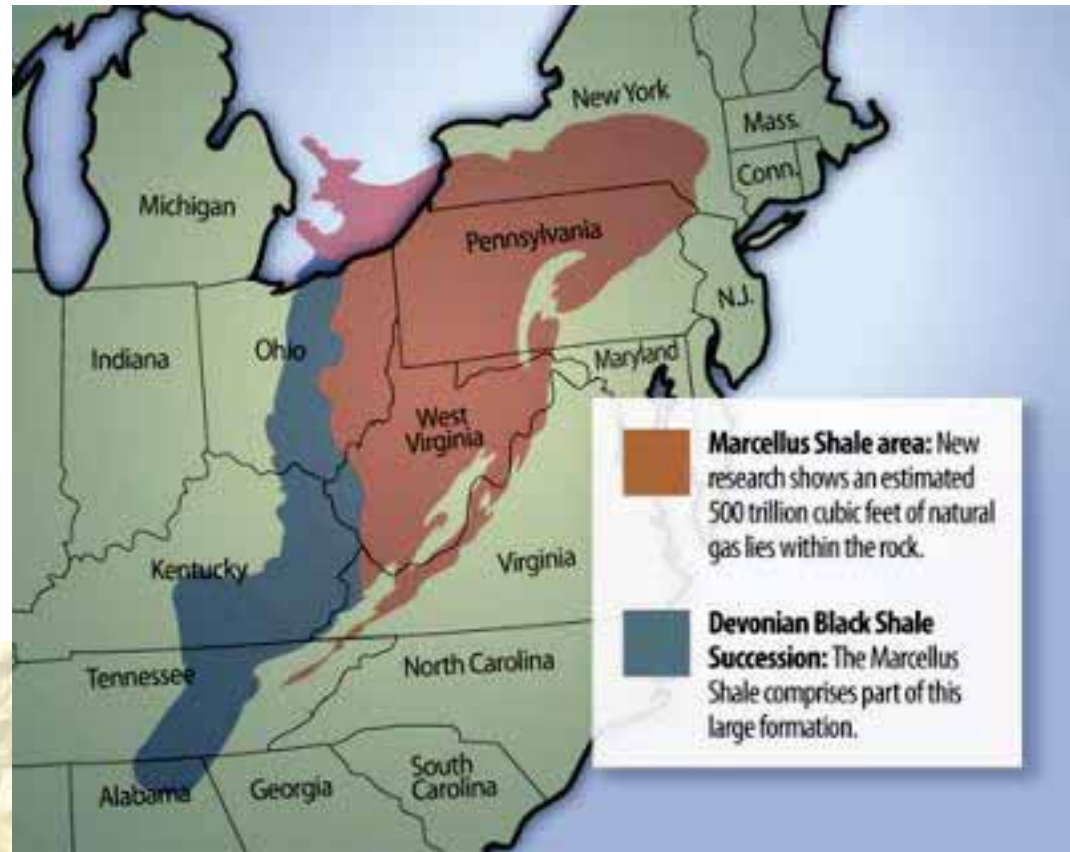


Source: <http://co.williams.com/williams/news-media/asset-maps/>

Planning Growth

Williams has an aggressive growth plan which includes billions of dollars in capital expansion by 2020. One area we have a lot of activity is in the Marcellus Shale.

In order to grow at this rate we need effective and efficient tools at our fingertips.



Source: <http://www.catskillmountainkeeper.org/our-programs/fracking/marcellus-shale/>

Consequences of Poor Planning

Possible B.C. pipeline route crosses grizzly bear sanctuary

BY BRUCE CONSTANTINEAU VANCOUVER SUN SEPTEMBER 7, 2013

Recommend 561 | Tweet 52 | Like 19 | 3 | Read 1 | Comment -27 | ShareThis

STORY PHOTOS (1)



MORE ON THIS STORY

- The North: B.C.'s economic frontier
- Stephen Hume: It's not hunting, and a grizzly bear's head and paws are not trophies
- Vaughn Palmer: Questions remain about viability of massive LNG projects in B.C.

Tremont Resident Upset with Pipeline Route

TREMONT - The Entbridge Pipeline, a 600-mile project crossing four states to deliver crude oil is under construction in Central Illinois, but it's awakening some resident's property in its path.

"It's within 100 feet of the house here. They came right through the driveway, which they say they have the right of way to go anywhere on your property that they want to," said Tremont resident Rod Stutyn.

The pipeline is being built right down the middle of Stutyn's property, taking down some old oak trees with it.

"When they cut the trees down that's going to be a sad day, you know they've been there for 200 years and it's non-replaceable," Stutyn said.

The project is cutting down oaks, evergreens and leaving out part of his driveway, but Stutyn says he's most upset about the oak trees. He said they provide shade, privacy and add value to his property. Entbridge has the right of way because of a deed signed by then-property owners in 1961. Entbridge spokesperson Kevin O'Connor said everyone living there now will be compensated.

Proposed Bluegrass Pipeline route will avoid nuns' land, company vows

Published September 4, 2013

Recommend 210 | Tweet 20 | Like 7 | Print | Email

By Staff wire reports — Associated Press

LOUISVILLE — A spokesman for a company building a pipeline through Kentucky says the proposed route would avoid land owned by a group of Roman Catholic nuns after having been ruled ineligible for eminent domain of the underground law.



Aug 22, 2013, 7:08am EDT

Report: Protected land in Dougherty County on proposed pipeline route

Carla Caldwell, Morning Edition Editor

Protected land in northwest Dougherty County, Ga., is part of a proposed route that would bring a 465-mile natural gas pipeline from central Alabama to northeast Florida and possibly run through much of the county, reports the Albany Herald.

As word of the project has spread, there has been a growing local grassroots movement to stop Spectra Energy Corp. from building the pipeline through the Georgia county, the paper reports.

Spectra is considering a number of routes for the Sabal Trail project, one of which would take it through much of Dougherty County, the Albany paper reports. That route would include 55 miles of pipeline in Alabama, 196 in Georgia and 214 in Florida, the paper said.

Nobody wants this reputation



The Need

- > Choosing the best route requires the resolution of complex interactions of engineering, environmental and social concerns



- > How did we perform routing in the past?




Intelligent Routing

- > Factors to consider include:
 - > Environment
 - > Urban areas
 - > Other DOT Class Locations
 - > Obstacles such as roads, trees, or other's right-of-way
 - > Property rights
 - > Current land use
 - > Geologic formations
 - > Contribute to slope
 - > Sub-surface conditions
 - > Existing assets and land right-of-way
- > What are we trying to connect?



Intelligent Routing

> How it all began.....

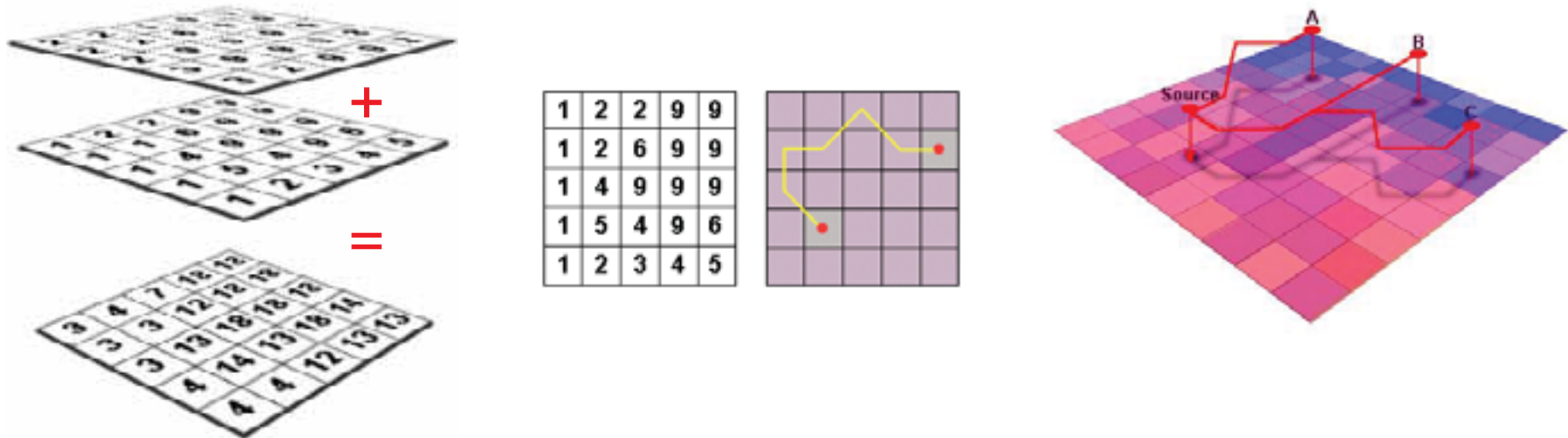
- > In 2011 our Midstream business GIS team made contact with a vendor who had figured out how to use some of ESRI's out-of-the-box tools to create a unique analysis of all factors that could need to be considered when crossing land with a pipeline route.
- > Earth Analytic, Inc., has been doing this work for many years and for other industries, marketing their SmartFootprint tools. 
- > The SmartFootprint route selection toolset uses raster analysis to determine least cost path routing of any linear feature – could be a new highway.
- > The special skills that EAI provides their clients is years of knowledge on how to transform various vector and raster data sources, factoring their weight and impact on a project, into a cost surface raster that is the basis for the last cost path analysis.
- > In 2012, Williams Midstream began using the EAI SmartFootprint Desktop tools in the ArcMap desktop client. Williams' Information Management teams began analyzing how to best deploy in a web map application for general user consumption. Build vs. Buy?
- > On June 3, 2014, Williams deployed a web version of Pipeline Router.
- > By the end of 2014, with EAI's help, Pipeline Router will cover the lower 48 U.S. states.

> Earth Analytic, Inc.

- > ESRI Business Partner
- > President – Wetherbee Dorshow



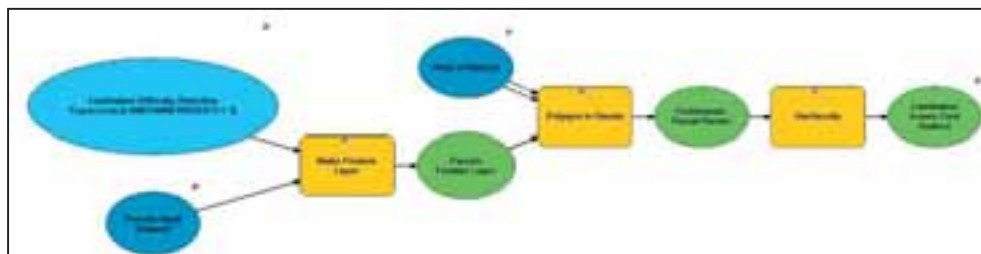
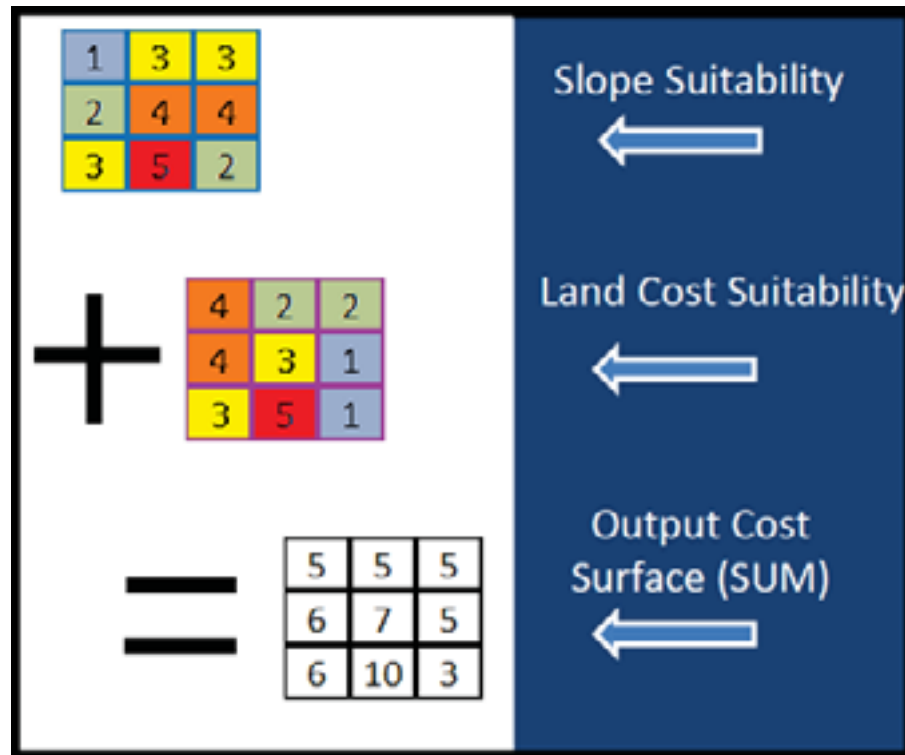
ArcGIS Distance Analysis Technology Overview



The ArcGIS Weighted Distance Analysis allows us to assign risk values to raster cells and to generate automatic pipeline routing by finding the cells from point A to point B with the least cumulative value.

How Pipeline Router works – Design Concepts

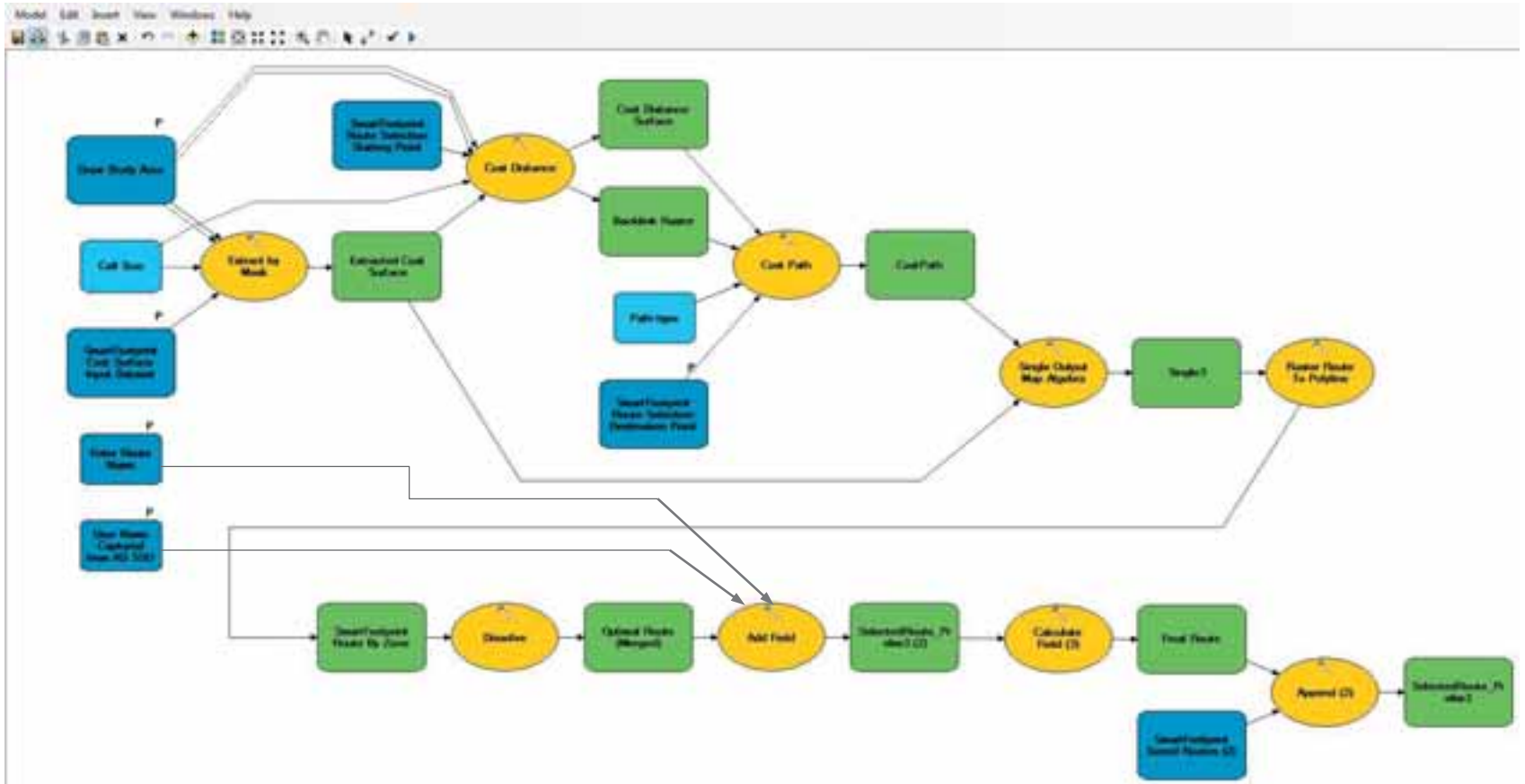
Criteria	Component Model	Component Model Ranking Strategy	SmartFootprint Model Score
Streams and Water Bodies	Water	Cold water fisheries	3
		Exceptional value	5
		High Quality (CWF)	5
		High Quality (TSF)	5
		High Quality (WWF)	5
		Warm water fisheries	3
		Trout Stocking fisheries	3
		Other perennial stream	5
		Intermittent Stream	3
		Wild Trout Streams	5
		Water Bodies (Polygons)	5
Wetlands	Wetlands	Wetlands (NWI Or Delineated)	5
		All other lands	0
RTE and Cultural Resources	Rare and Endangered Flora and Fauna	Buffer points (66 ft Radius)	5
Mining	Mining Areas (Quarries and Coal)	Quarries	Use Lookup
		All other lands	0
Slope	Slope	0 to 6	0
		6 to 12 = 1	1
		12 to 18 = 2	2
		18 to 24 = 3	3
		24 to 30 = 4	4
Side Slopes	Side-Slope Avoidance	steep side slopes (>25%)	5
		All other lands	0



- None
- 1 Very Low
- 2 Low
- 3 Moderate
- 4 High
- 5 Very High

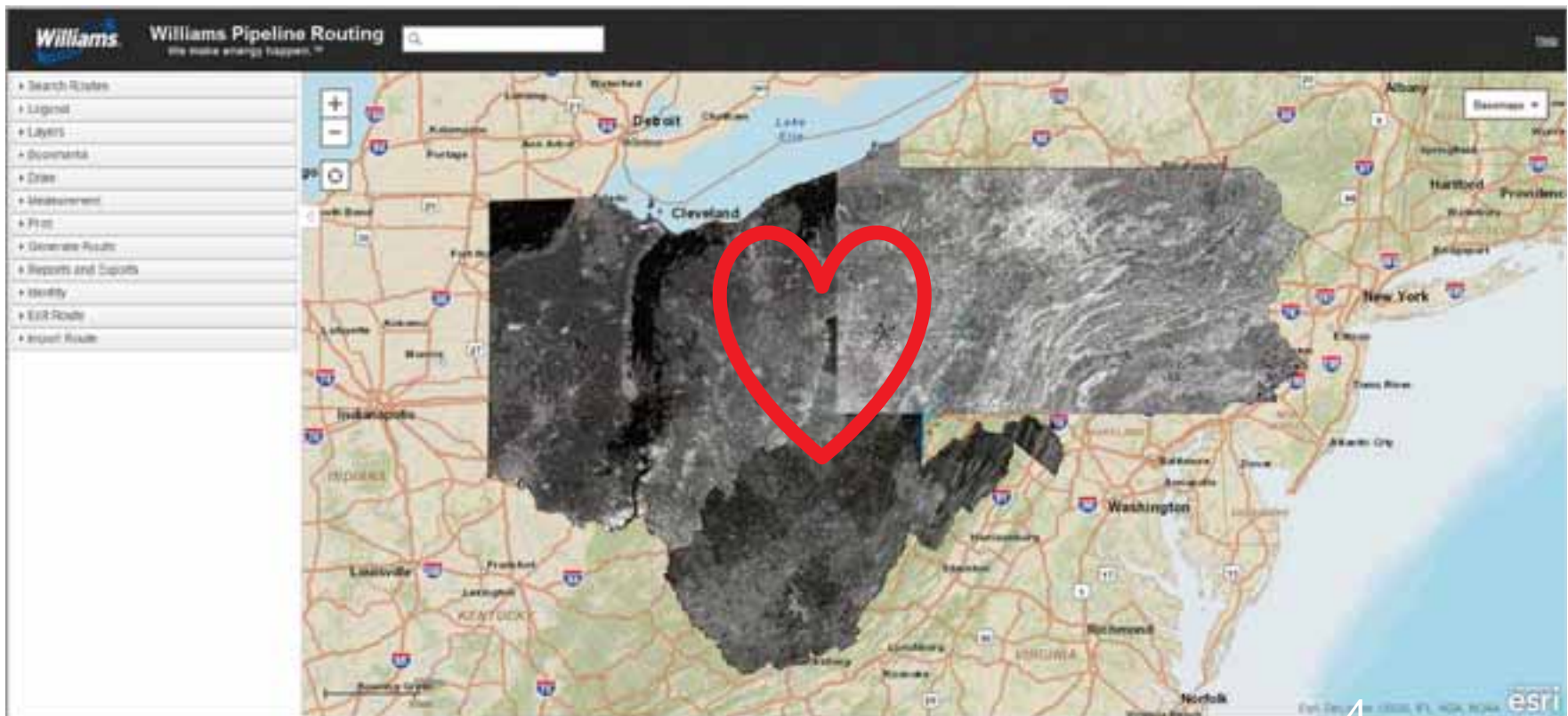


Model Deeper Dive



How Pipeline Router works – Design Concepts

- > It needs to be in a web viewer – no software to install – easy to use!
- > Expected Audience – FEED (Front End Engineering and Design) Engineers, Capacity Planning Engineers, Land Teams



Case Study

- > Connect well pad to existing pipeline, approx. 1.5 miles

Williams Pipeline Routing
We make energy happen.™

Search Routes
Legend
Layers
Bookmarks
Draw
Measurement
Print
Generate Route

Step 1: Collect Route Information

Route Information
Route Name*: Reynolds
***Route Name is Required**
Operating Area: Gathering

Back Next Submit

Reports and Exports
Identify
Identify in: Operational Layers
Identify Identify On

Edit Route
Import Route

Done

Local Intranet | Protected Mode: Off

100%

LINE_DESCR - BUSH

LINE_DESCR	BUSH
OPERATOR_CL	WFS
TYPE_CL	OWNER/OPER
COMPANY_GCL	WFS
SOURCE_GCL	WILLIAMS
LINE_TYPE_CL	GATH

Well Name - Reynolds, R. 3H
(1 of 3)

Well Name	Reynolds, R. 3H
TD_Date	10/31/2013
TIL_Date	1/8/2014
Latitude	41.816771
Longitude	-76.009184
Stages	21
Comments_from_CraigFull	
TIL_YEAR	2014
Update_Received	4/14/2014

Zoom to

Case Study

▼ Draw

- ▶ Measurement
- ▶ Print
- ▼ **Generate Route**

Step 2: Collect Route Geometry Inputs

Draw start location, end location, and waypoints for the route

Route Inputs:

Number of Route Features: 3

Absolute Waypoint

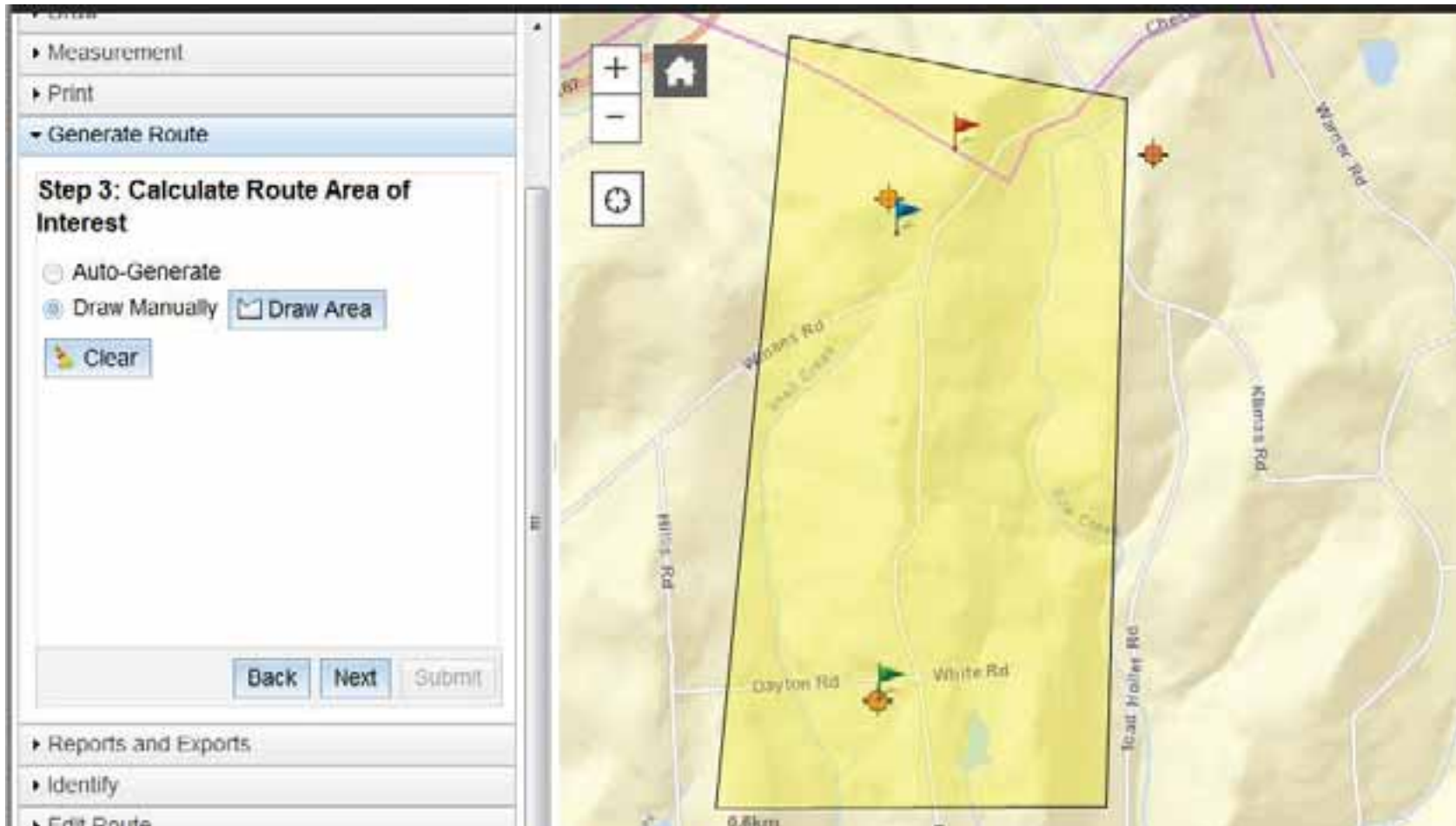
Draw Start

Draw End

▶ Reports and Exports

▶ Identify

Case Study



Case Study

Generate Route

Step 4: Adjust Raster Weightings

Select State:
Pennsylvania

DwellingDensity:	6
Hydrology:	6
LandOwner:	6
Lease:	6
Mining:	6
Parcels:	6
PipelineCorridor:	6
ProposedWellsProx:	6
Protectedlands:	6
ProtectedSpecies:	7
ROW:	7
SideSlope:	6
Slope:	7
SurficialGeology:	7
Transportation:	6
Wetlands:	6
Total:	100

Back Next Submit

Step 5: Review Route Details

Press submit to perform route calculation

Route Name: Reynolds
 Created By: WILLIAMS\TBurgard
 Number of Waypoints: 3
 Area of Interest: Manually Drawn on Map
 Custom Weightings: Custom Weightings Applied

Back Next Submit

Case Study

Generate Route

Reports and Exports

Select Route

Select Route Generate Crossings

Selected Route: Reynolds

This route has **no** crossing report. Would you like to run one now? **Yes**

Crossing Layers

- Hydrology
- Railroads
- Roads
- Bedrock Depth
- Geology
- Land Use
- Parcel
- Protected Land
- Wetlands

Map Labels: State Route 267, California Rd, Dry Rd, Hills Rd, Reynolds Rd, Small Canal, Dayton Rd, White Rd, Chestnut Rd, Board Walker Rd, Rose Creek

Scale: 0.6km

Case Study

Williams Pipeline Routing
We make energy happen.™

▼ Reports and Exports

Select Route

Select Route

Selected Route: Reynolds

Crossing Layers

- Hydrology
- Railroads
- Roads
- Bedrock Depth
- Geology
- Land Use
- Parcel
- Protected Land
- Wetlands

Downloads

Roads ✕

Name	Road Type
T433	L
T533	L



Case Study

Sample of a Crossing Report

OBJECTID	RouteID	Grid_Code	Type	Detailed_Type	LengthFeet	SHAPE_len
1	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	21		Hay/Pasture	4819.473495	1377.636485
2	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	21	Developed	Developed, Open Space	83.2146785	25.3821212
3	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	21	Forest	Deciduous Forest	1806.485826	550.6117415
4	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	22	Forest	Evergreen Forest	861.3696247	262.5422223
5	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	23	Forest	Mixed Forest	1698.067183	487.8908617
6	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	30	Planted/Cultivated	Cultivated Crops	1611.768167	460.7872273
7	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	32	Shrubland	Shrub/Scrub	174.2600974	53.11462839

OBJECTID	RouteID	Name	Use Description	Reach Code
1	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	Snail Creek	CWF/COLD WATER FISHE	92050106001418

OBJECTID	RouteID	Road_Type	Name	State
1	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	L	T433	
2	{37C9AE10-8DC7-4018-BA29-D3337C2C6A65}	L	T533	

OBJECTID	PARCEL_ID	APN	Owner	Site_Address	Site_City	Site_State	Site_Co	Acres	Use
1	48863488	120 00-2 001 01.000		ROUTE T-8433	MONROE	PA	78881	20.137329828689	(17C)
2	48863487	120 00-2 811 00.000		ROUTE L81567	MONROE	PA	78881	18.4201819566449	(17C)
3	48863487	120 00-2 802 00.000		ROUTE T-8433	MONROE	PA	78881	50.5397916198719	(17C)
4	48863488	120 00-2 802 00.000		ROUTE T-8433	MONROE	PA	78881	51.8848343501377	(17C)
5	48863487	120 00-2 808 03.000		ROUTE L81567	MONROE	PA	78881	39.555277788328	(17C)
6	48863488	120 00-2 804 00.000		1096 COPPIN HILL RD	MONROE	PA	78881	50.3268543702707	(17C)
7	48863488	120 00-2 808 00.000		876 DAYTON RD	MONROE	PA	78881	54.8813268236117	(17C)
8	48863488	120 00-2 813 00.000		ROUTE L81567	MONROE	PA	78881	37.1222612479933	(17C)
9	48863488	120 00-2 802 01.000		ROUTE L81567	MONROE	PA	78881	51.988641100077	(17C)



Future Tool Enhancements

- > Additional states and operating areas to be added
- > Non-absolute waypoints
- > Start or end on linear feature (existing pipeline/right-of-way)
- > Ability to type in the x/y coordinate vs. point and click
- > Ability to import coordinates, routes, AOI, or exclusion areas
- > Enhanced Security Groups
- > Migrate to enterprise map viewer solution – Geocortex
- > Elevation Profile tools to be added





Questions



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