RIMORPHIS

River Morphology Information System

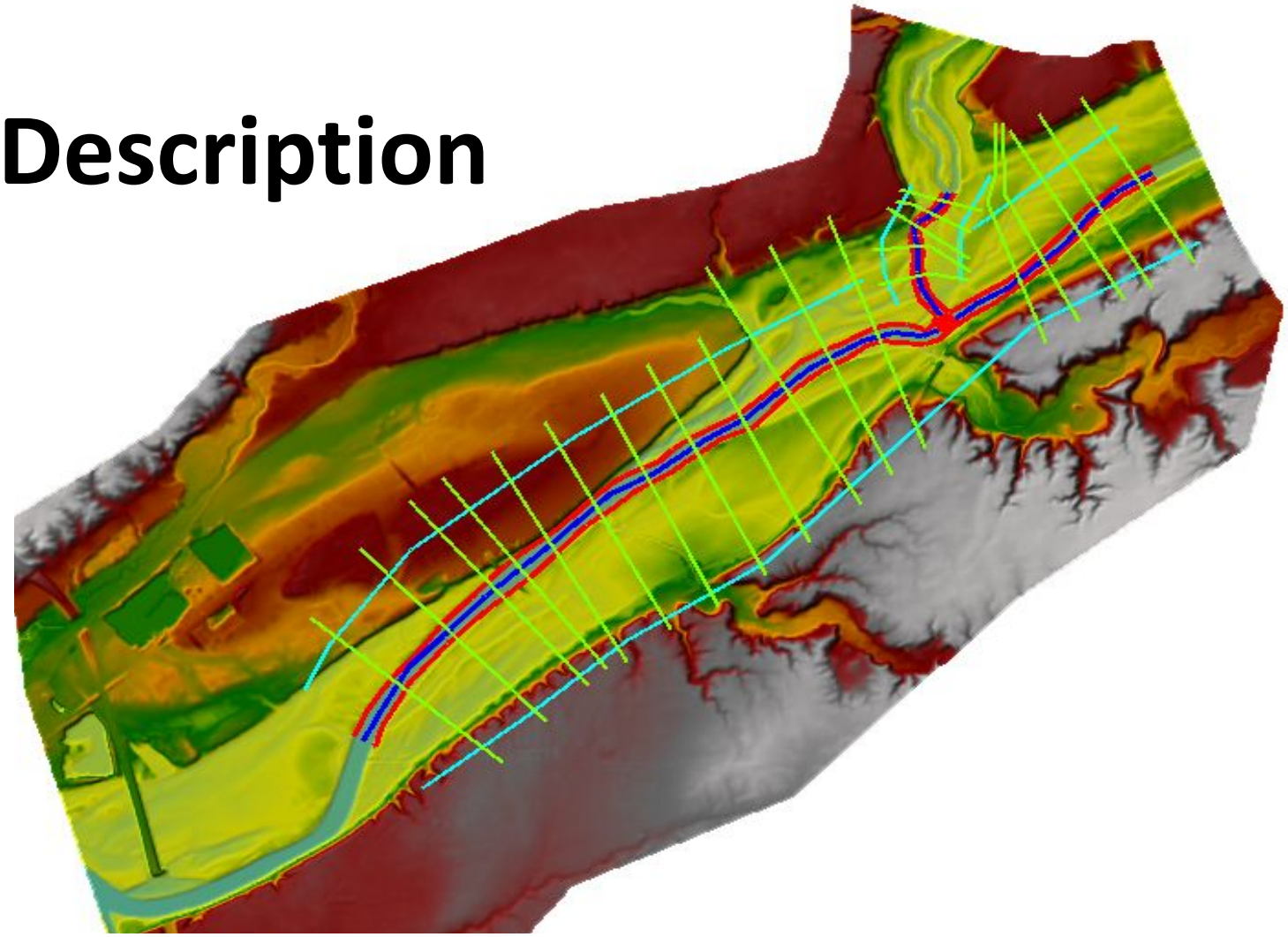
Project Overview

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1st Annual Stakeholder Workshop
May 12 & 19, 2021

River Morphology Description

SHAPE AND COMPOSITION OF RIVER CHANNELS THAT CHANGES WITH SPACE AND TIME



Datasets: river centerline, bank lines, bathymetry, bed and bank material composition

Why we need river morphology data?

- Hydrodynamics
- Sediment transport
- Morphodynamics
- Nutrient transport
- River eco-habitat
- Management of river resources and river infrastructure

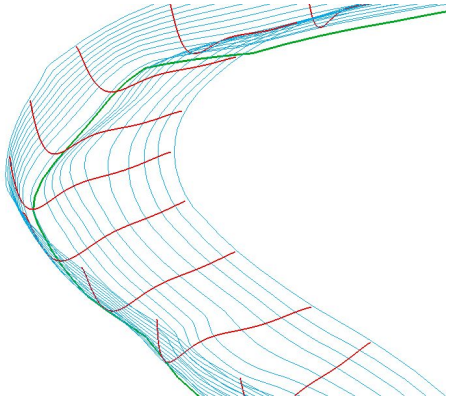
Current status of river morphology data

- Accessibility
  - many datasets are not publicly available, collected by individual researchers/agencies and stored in different places
- Availability
  - most data related to river bathymetry, sediment and hydrodynamics are collected for small reaches
- Interoperability
  - most data are not available in a form that can be easily used for many applications
- Usability
  - tools for analyzing river morphology data are scattered and not easily available for public use, proprietary, platform dependent

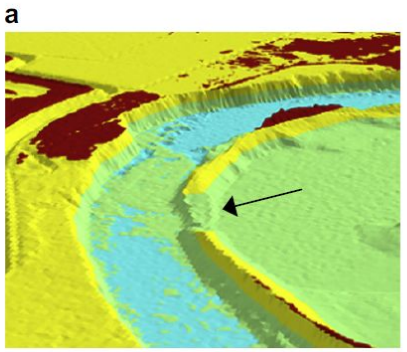
RIMORPHIS Solutions

- Accessibility - Easy access to river morphology data at multiple scales in one location
- Availability - Provide river morphology data over large areas by combining and complementing with other resources
- Interoperability - Pre- and post-processing of river morphology data
- Usability - Enable data driven research and applications

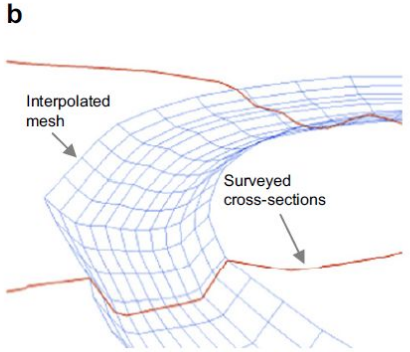
Earlier Work (UT Austin, Purdue)



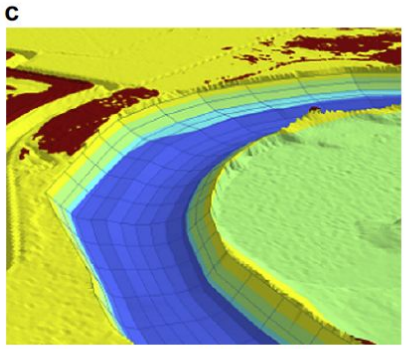
RCMM (2004)



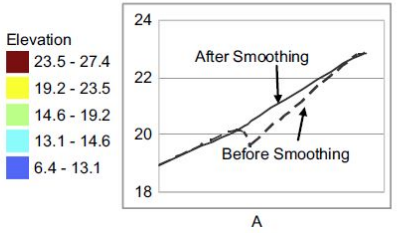
TIN created from LIDAR grid points



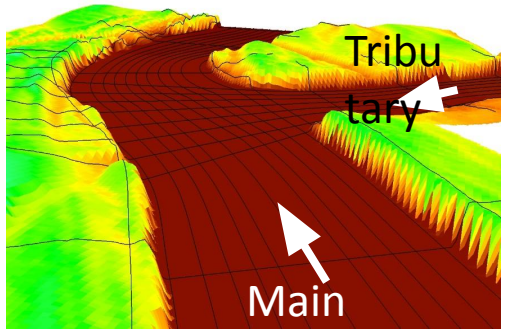
Interpolated mesh from HEC-RAS cross sections

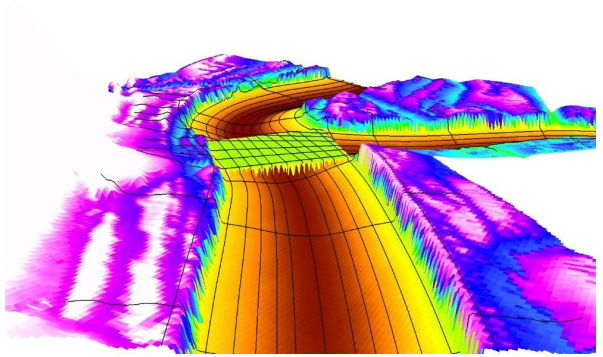


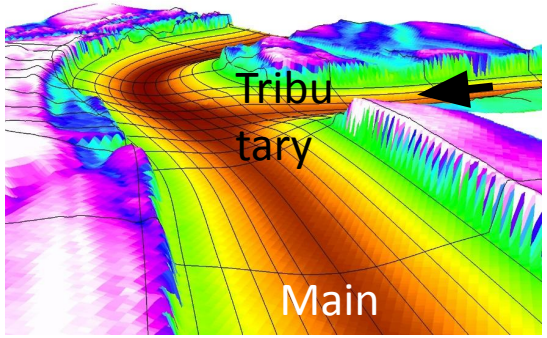
Integrated river terrain (TIN) from LIDAR grid points and channel mesh



Bathymetry Interpolation Tool (2008)

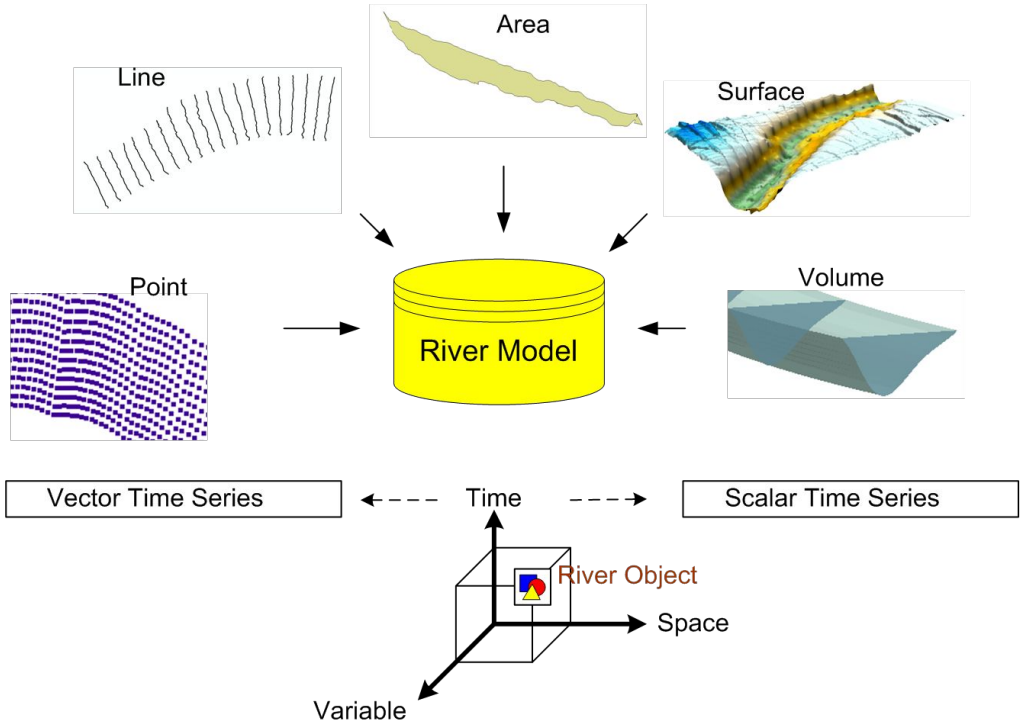




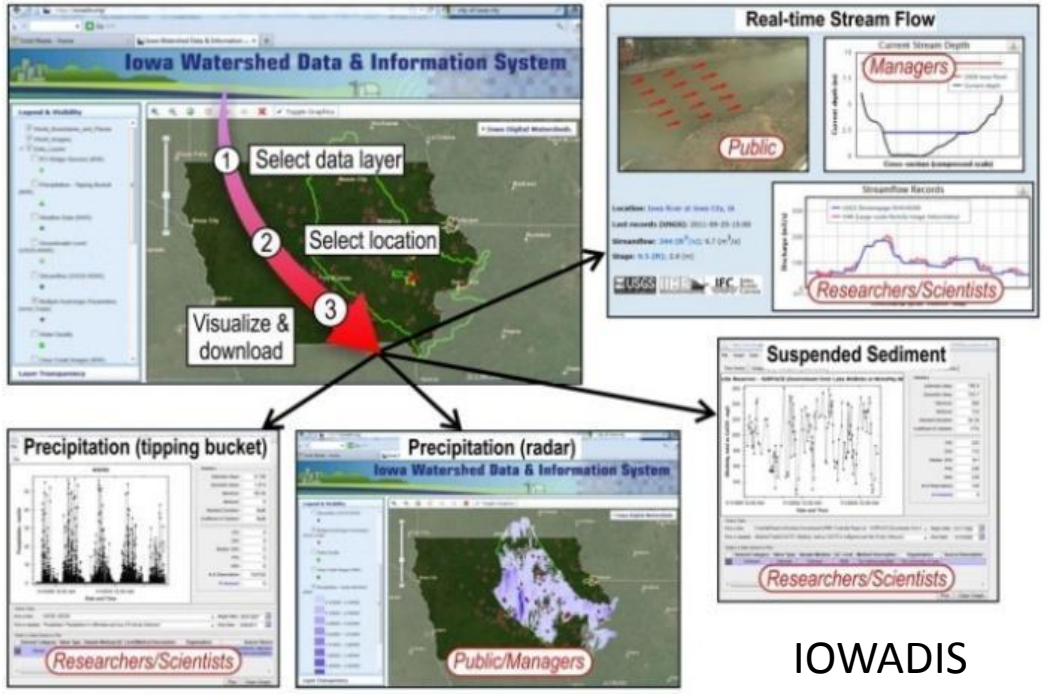


SPRING (2019 – present)

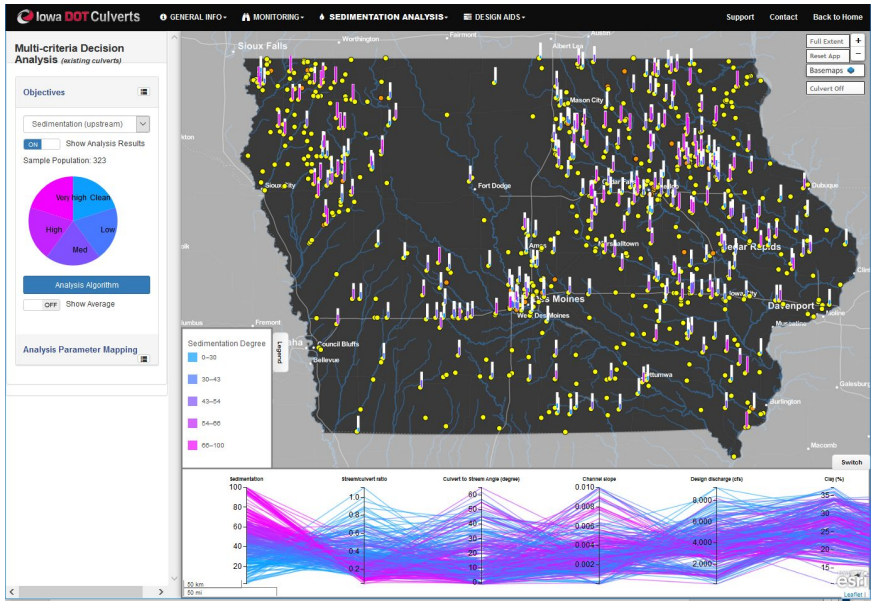
Earlier Work (Iowa)



ArcRiver (2015)

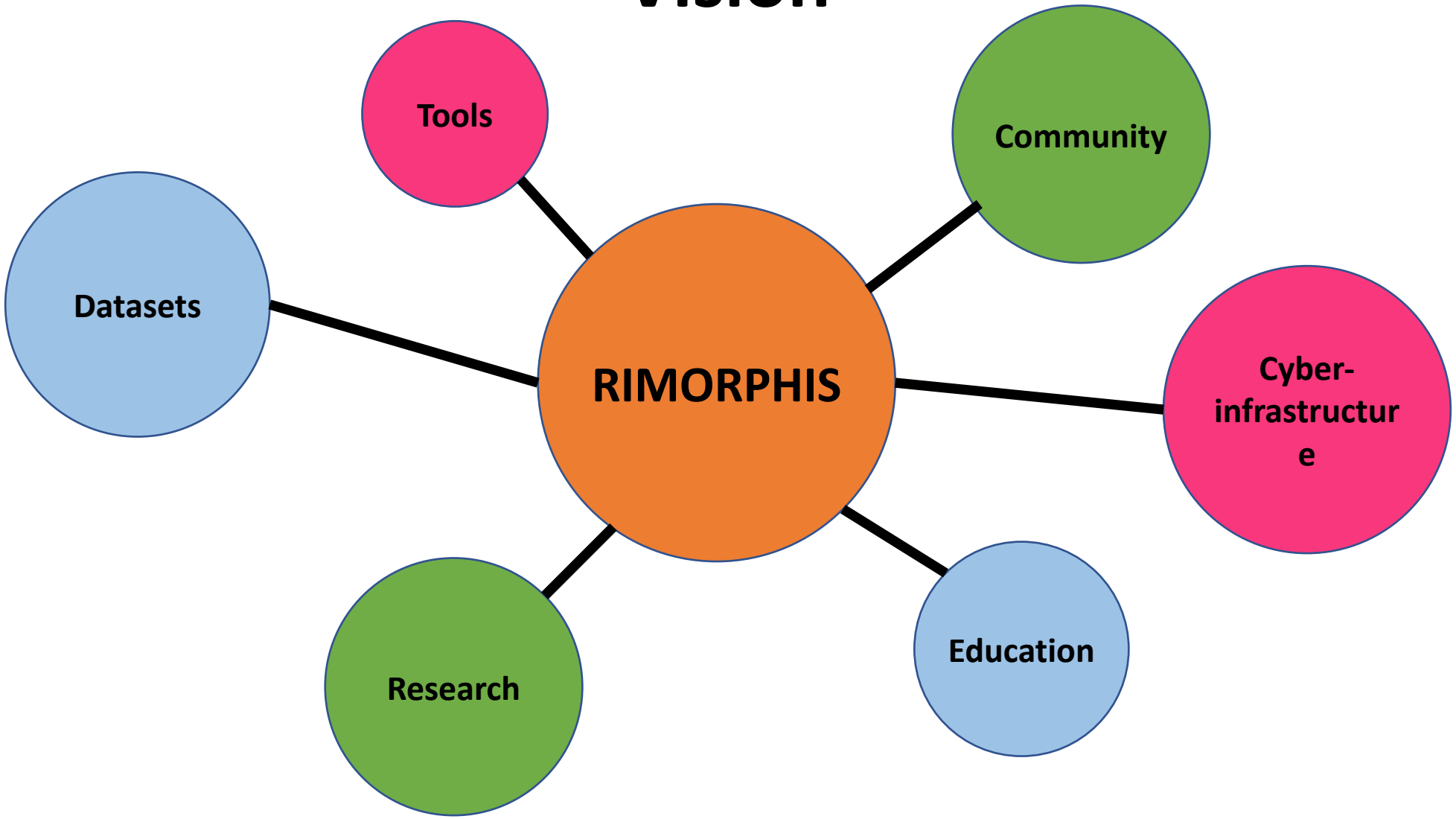


IOWADIS



IOWADOT

River Morphology Information System (RIMORPHIS) Vision



NSF Geoinformatics Program (NSF 19-561)

- The **GI Catalytic Track** will support pilot geoinformatics development efforts that are intended to serve Earth Science research.
- The **GI Facility Track** will support awards for implementation and operation of a cyberinfrastructure resource relied upon by one or more Earth Science communities to address science questions.
- The **GI Sustainability Track** will support development and implementation of sustainable funding models to preserve data and software products of value to Earth Science research.

NSF Collaborative Research Project

River Morphology Data and Analysis Tools (RiverMorph):
A Web Platform for Enabling River Morphology Research
<new name: RIMORPHIS>



Awards: #1948938 - #1948944 - #1948972 - #1948940

(August 2020 – July 2023)

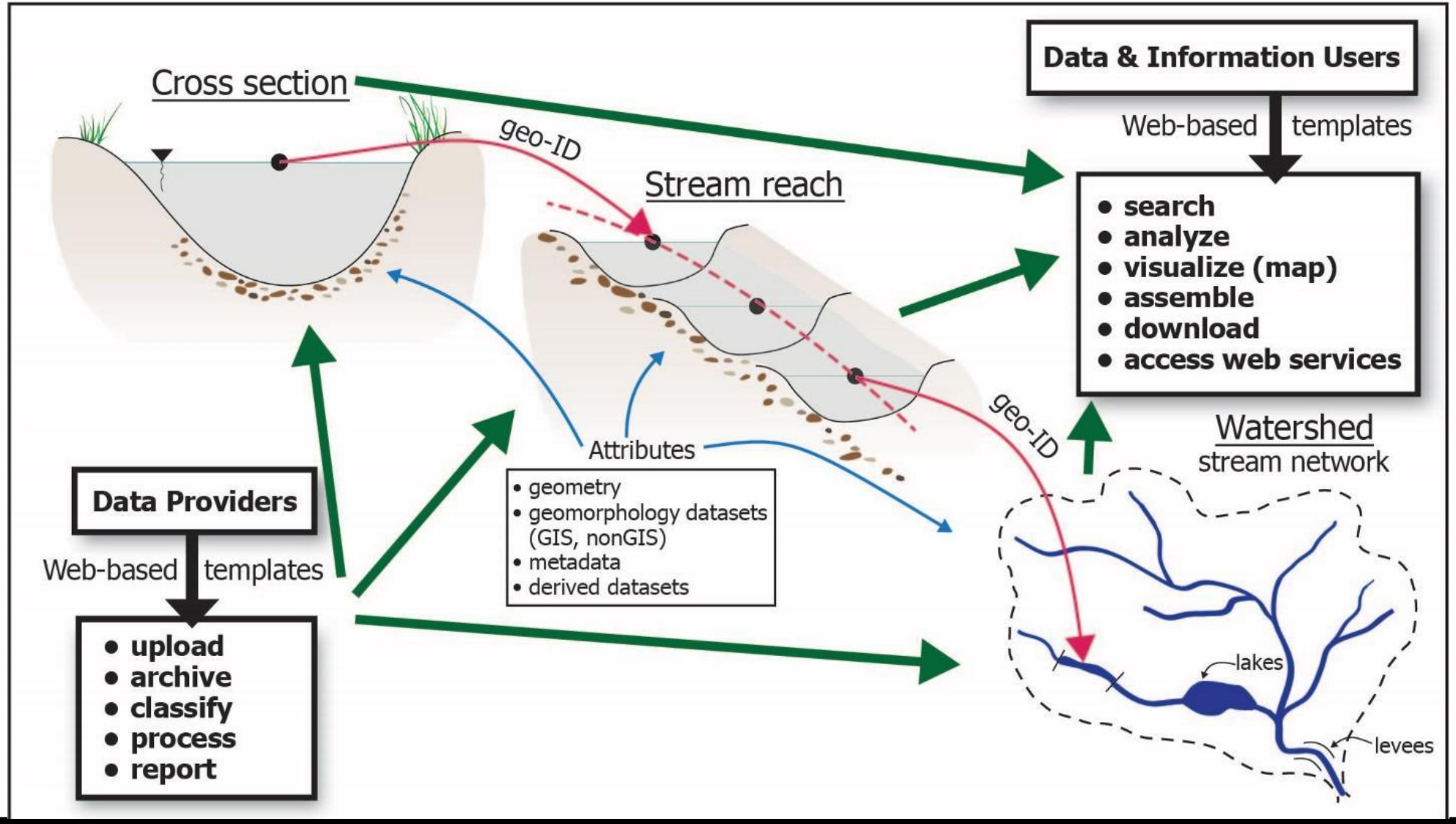
PURDUE UNIVERSITY

THE UNIVERSITY OF IOWA

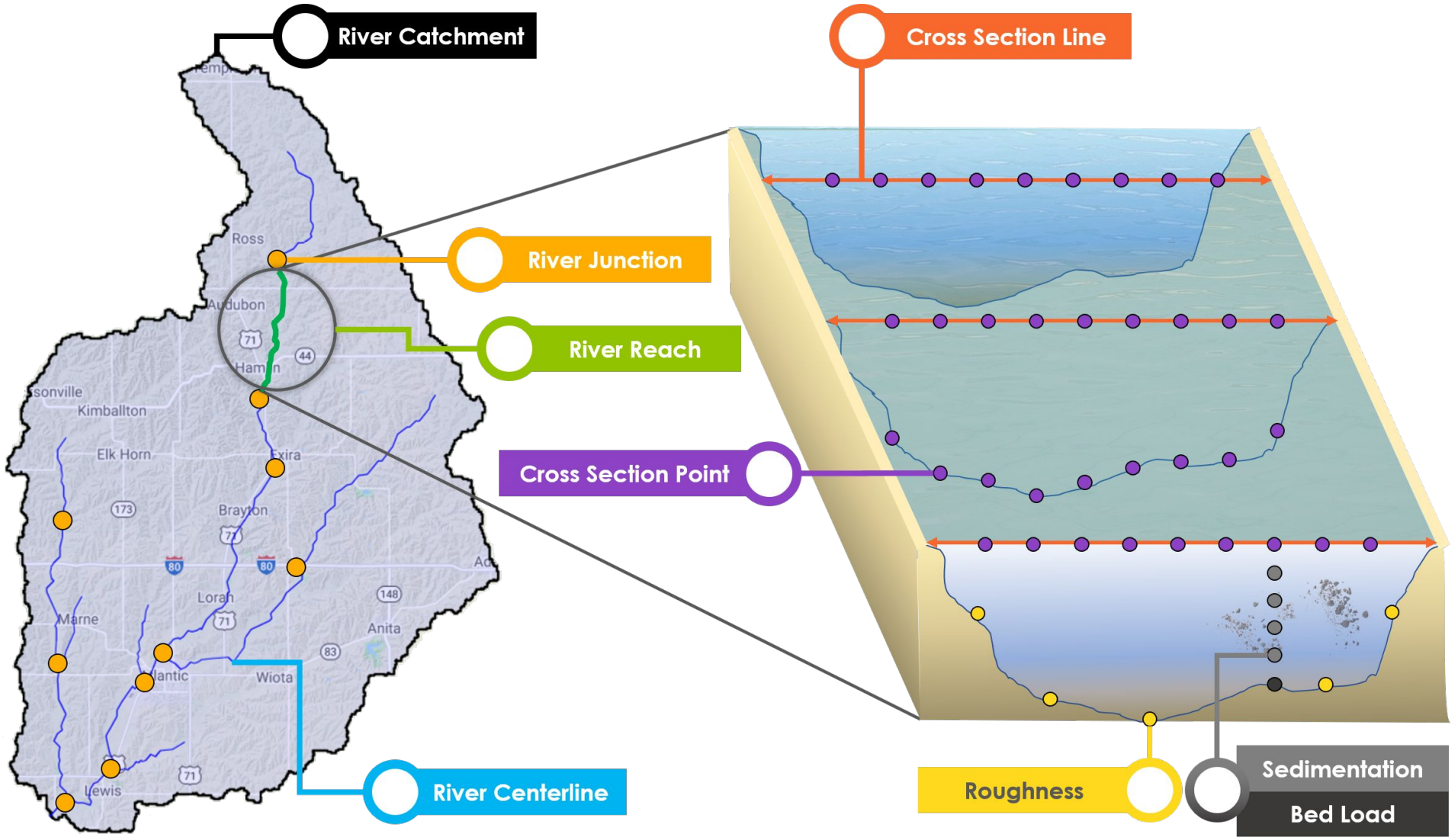
SAINT LOUIS UNIVERSITY
EST. 1818

University of Colorado Boulder

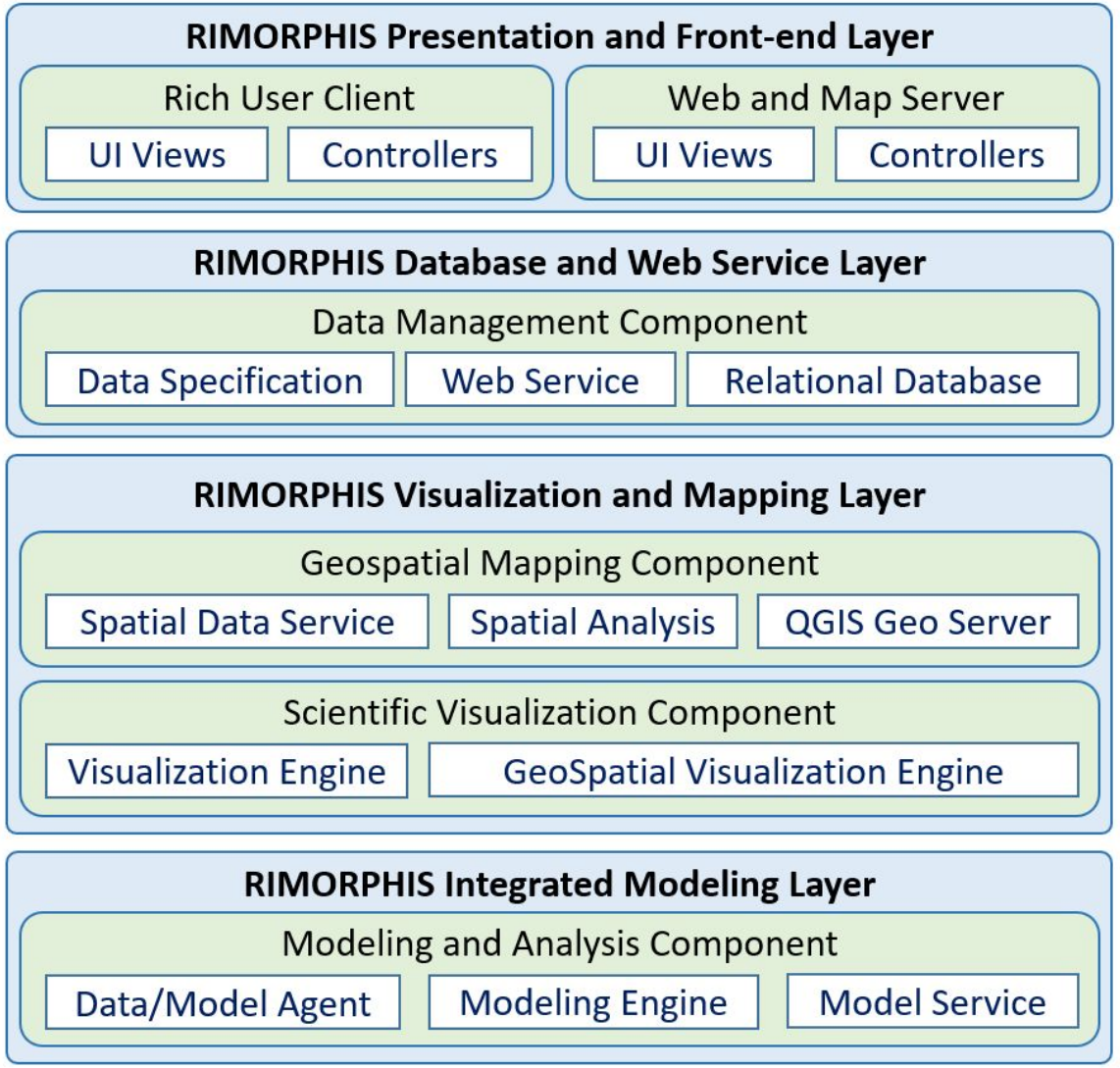
RIMORPHIS: Functions



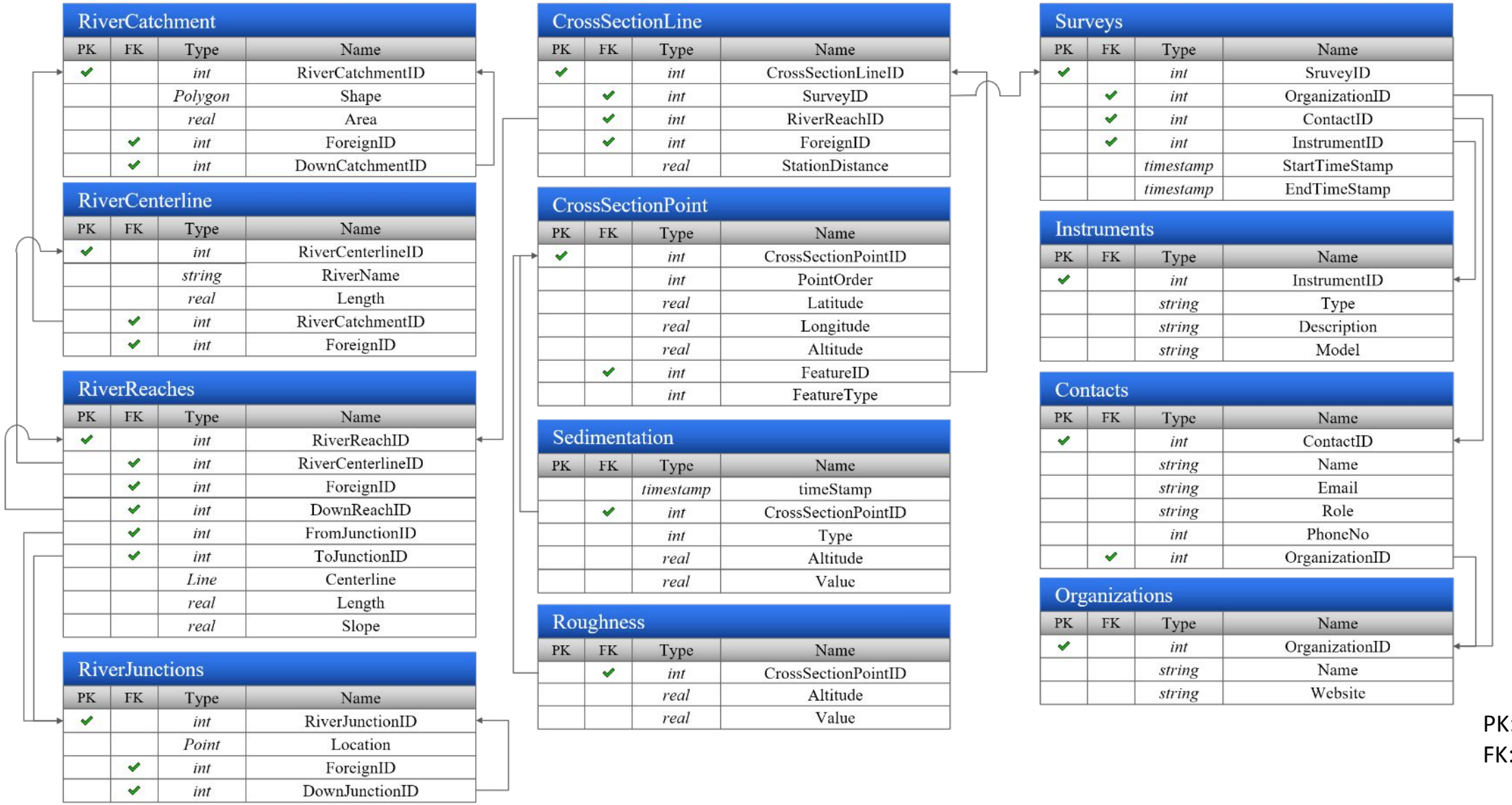
RIMORPHIS: Features



RIMORPHIS: Architecture



RIMORPHIS: Data Model



RiverCatchment

PK	FK	Type	Name
✔		*int*	RiverCatchmentID
		Polygon	Shape
		real	Area
	✔	*int*	ForeignID
	✔	*int*	DownCatchmentID

RiverCenterline

PK	FK	Type	Name
✔		*int*	RiverCenterlineID
		string	RiverName
		real	Length
	✔	*int*	RiverCatchmentID
	✔	*int*	ForeignID

RiverReaches

PK	FK	Type	Name
✔		*int*	RiverReachID
	✔	*int*	RiverCenterlineID
	✔	*int*	ForeignID
	✔	*int*	DownReachID
	✔	*int*	FromJunctionID
	✔	*int*	ToJunctionID
		Line	Centerline
		real	Length
		real	Slope

RiverJunctions

PK	FK	Type	Name
✔		*int*	RiverJunctionID
		Point	Location
	✔	*int*	ForeignID
	✔	*int*	DownJunctionID

CrossSectionLine

PK	FK	Type	Name
✔		*int*	CrossSectionLineID
	✔	*int*	SurveyID
	✔	*int*	RiverReachID
	✔	*int*	ForeignID
		real	StationDistance

CrossSectionPoint

PK	FK	Type	Name
✔		*int*	CrossSectionPointID
		int	PointOrder
		real	Latitude
		real	Longitude
		real	Altitude
	✔	*int*	FeatureID
		int	FeatureType

Sedimentation

PK	FK	Type	Name
		timestamp	timeStamp
	✔	*int*	CrossSectionPointID
		int	Type
		real	Altitude
		real	Value

Roughness

PK	FK	Type	Name
	✔	*int*	CrossSectionPointID
		real	Altitude
		real	Value

Surveys

PK	FK	Type	Name
✔		*int*	SruveyID
	✔	*int*	OrganizationID
	✔	*int*	ContactID
	✔	*int*	InstrumentID
		timestamp	StartTimeStamp
		timestamp	EndTimeStamp

Instruments

PK	FK	Type	Name
✔		*int*	InstrumentID
		string	Type
		string	Description
		string	Model

Contacts

PK	FK	Type	Name
✔		*int*	ContactID
		string	Name
		string	Email
		string	Role
		int	PhoneNo
	✔	*int*	OrganizationID

Organizations

PK	FK	Type	Name
✔		*int*	OrganizationID
		string	Name
		string	Website

PK: Primary Key
FK: Foreign Key

RIMORPHIS: Data & Tool Resources

Data	
River bathymetry (bed elevation), river hydrography (centerline, banks, etc), sediment, channel roughness, river planform (aerial images)	
Sources	**Tools**
USGS National Hydrography Dataset (NHD)	USGS Stream Channel and Floodplain Metric Toolbox (SCDMT)
USACE Reservoir Sediment Information (RSI)	Geomorphic Change Detection (GCD) Software
USACE* Hydrographic Surveys (eHydro)	USACE Sediment Analysis & Geo-App (SAGA)
USGS National Water Information System (NWIS)	USGS DEM Geomorphology Toolbox
USGS Surface Water Oceanographic Topography (HYDRoSWOT)	USACE Cross Section Viewer
USGS 3-D Elevation Program (3DEP)	RCMM
USGS StreamStats	SPRING
USGS Vigil Network	
NRCS Regional Curves Datasets	

RIMORPHIS Use Cases

- **Discovery: Find and download hydro-morphologic measurements available in a specific stream reach**
- **Reach scale analysis: assembly & visualization of multi-instrument data acquisition**
- **Network scale analysis: bathymetry generation and hydraulic modeling; calibration/validation of remotely sensed data**
- **Forecasting: long-term channel morphology forecasting**

Project Timeline

RESEARCH ACTIVITIES		Year 1			Year 2			Year 3		
		FA	SP	SU	FA	SP	SU	FA	SP	SU
T1: Survey of relevant data sources and CI		x	x	x						
T2: Development of CI components & features	T2-1: Specifications & integration	x	x	x	x	x				
	T2-2: Mapping & visualization			x	x	x	x	x		
	T2-3: Data analytics & modeling			x	x	x	x	x	x	x
T3: Design test/use cases				x	x	x	x	x	x	x
Annual Workshop & Reports				x			x			x

Questions?