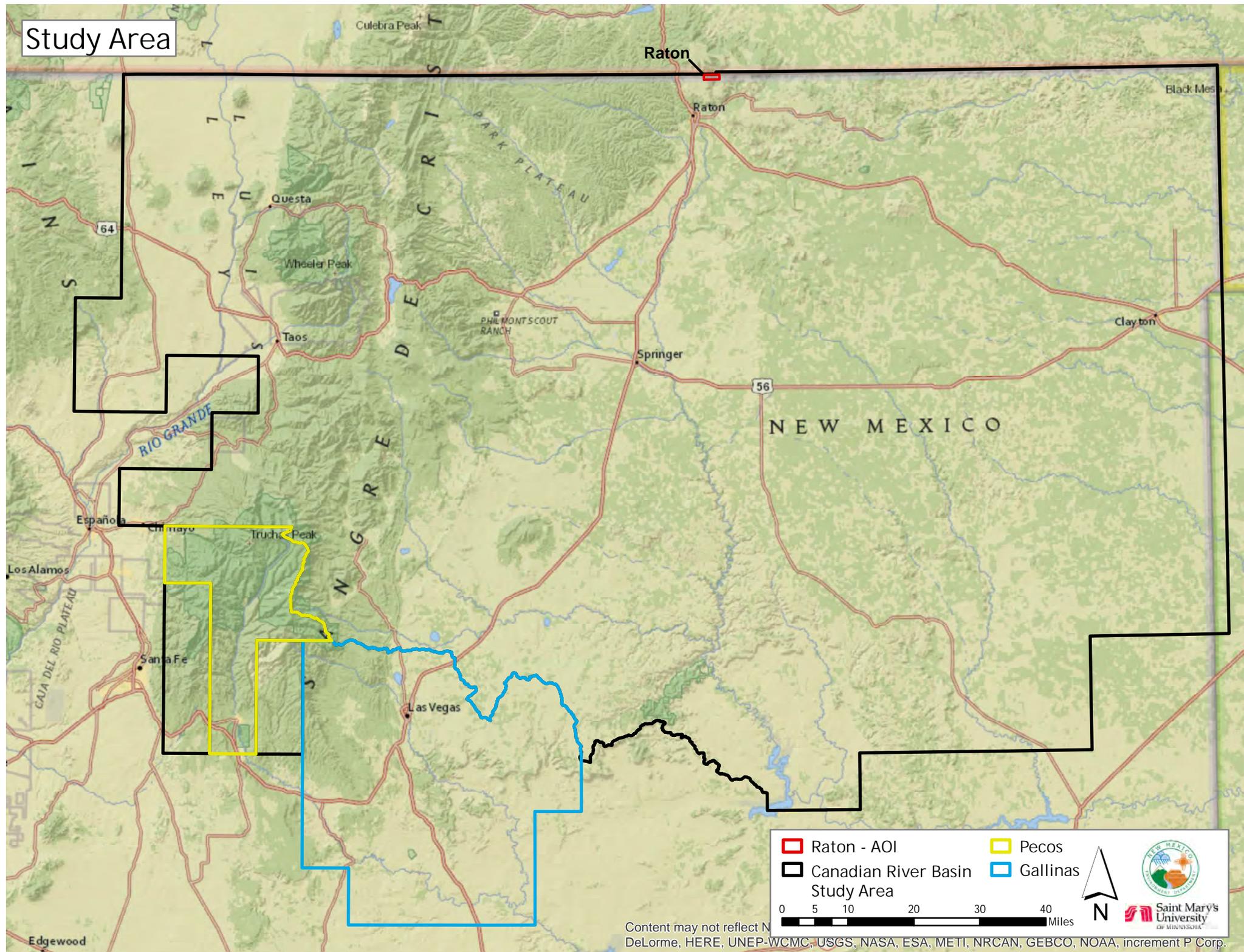


Study Area



Legend:

- Raton - AOI
- Canadian River Basin Study Area
- Pecos
- Gallinas

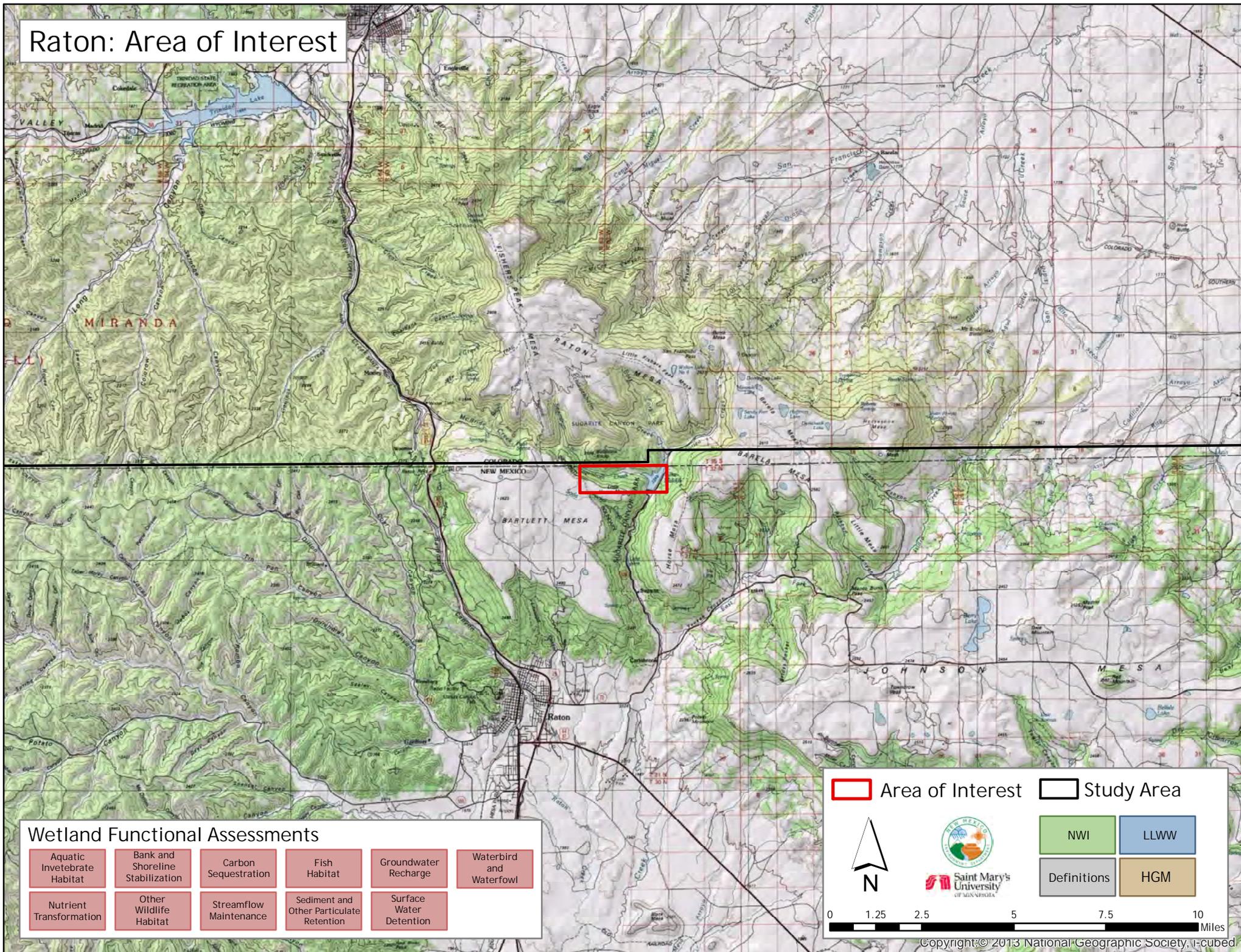
0 5 10 20 30 40 Miles

N

Saint Mary's University of Minnesota

Content may not reflect N
DeLorme, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

Raton: Area of Interest



Wetland Functional Assessments

Aquatic Invertebrate Habitat	Bank and Shoreline Stabilization	Carbon Sequestration	Fish Habitat	Groundwater Recharge	Waterbird and Waterfowl
Nutrient Transformation	Other Wildlife Habitat	Streamflow Maintenance	Sediment and Other Particulate Retention	Surface Water Detention	

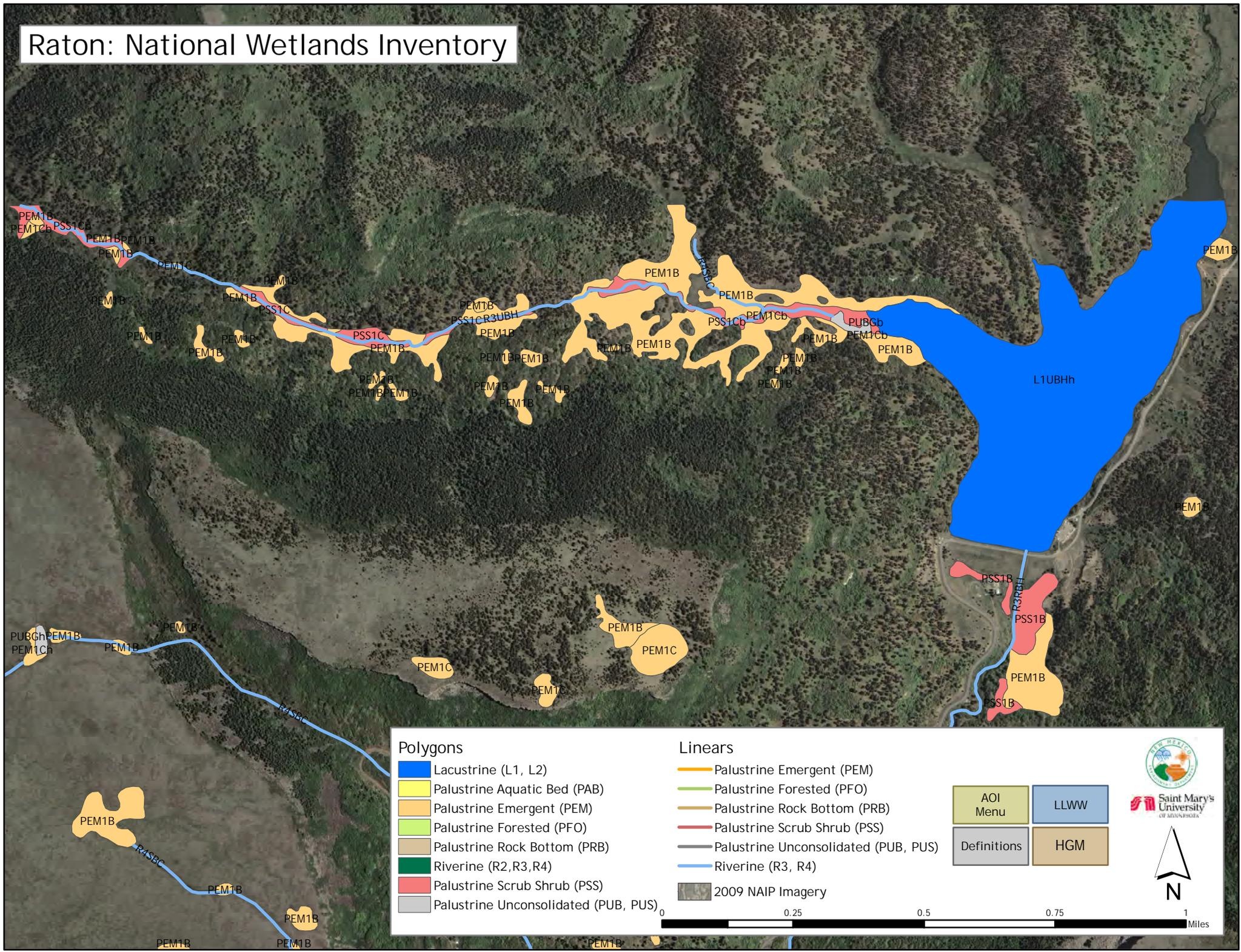
Area of Interest
 Study Area

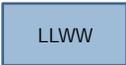


NW1	LLWW
Definitions	HGM

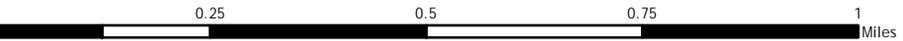


Raton: National Wetlands Inventory

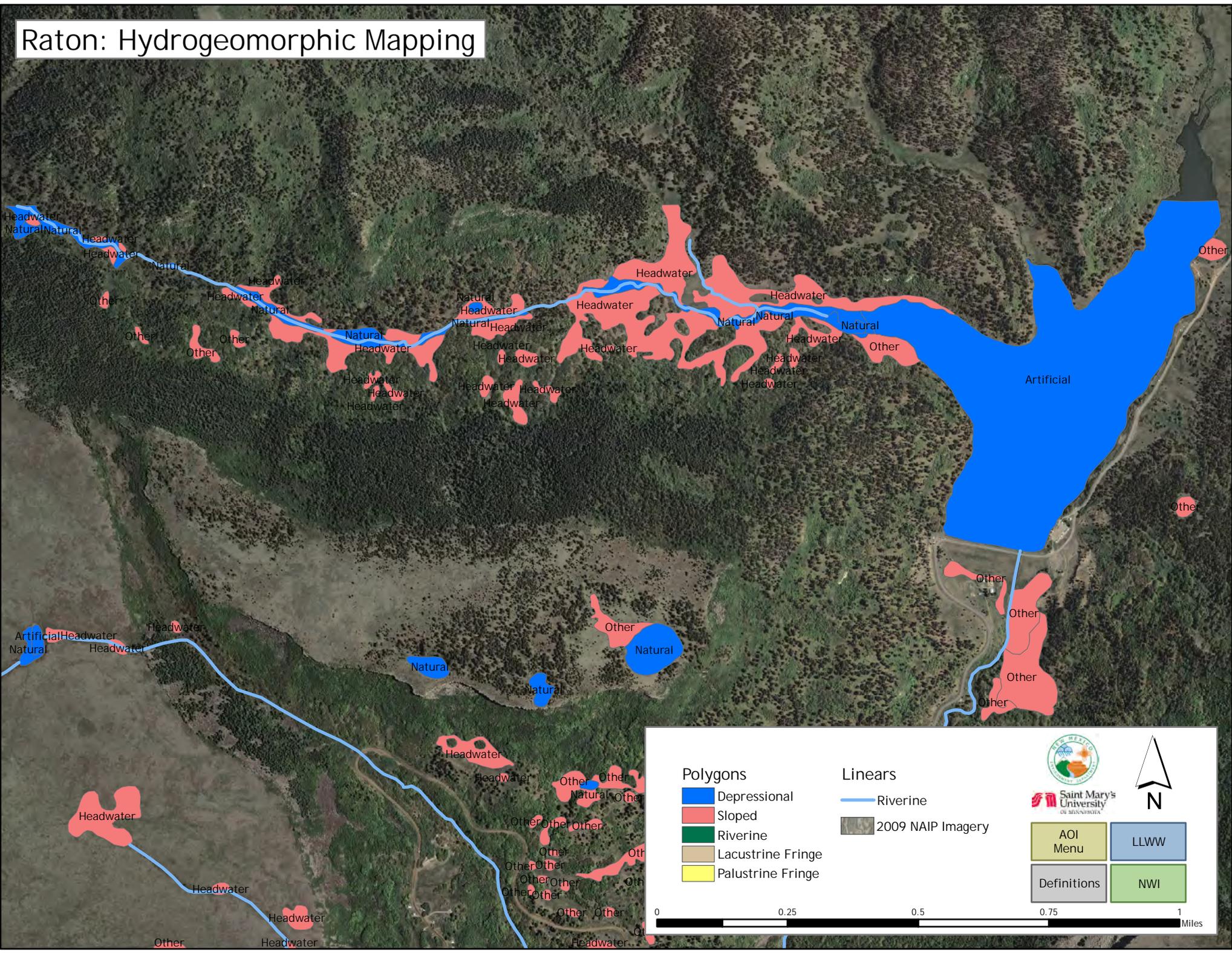


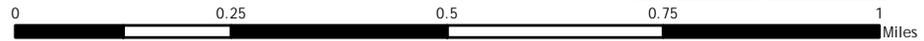
Polygons		Linears		 	
 Lacustrine (L1, L2)	 Palustrine Aquatic Bed (PAB)	 Palustrine Emergent (PEM)	 Palustrine Forested (PFO)	 Definitions	 HGM
 Palustrine Emergent (PEM)	 Palustrine Forested (PFO)	 Palustrine Rock Bottom (PRB)	 Palustrine Scrub Shrub (PSS)		
 Palustrine Rock Bottom (PRB)	 Riverine (R2,R3,R4)	 Palustrine Unconsolidated (PUB, PUS)	 Riverine (R3, R4)		
 Palustrine Scrub Shrub (PSS)	 Palustrine Unconsolidated (PUB, PUS)	 2009 NAIP Imagery			



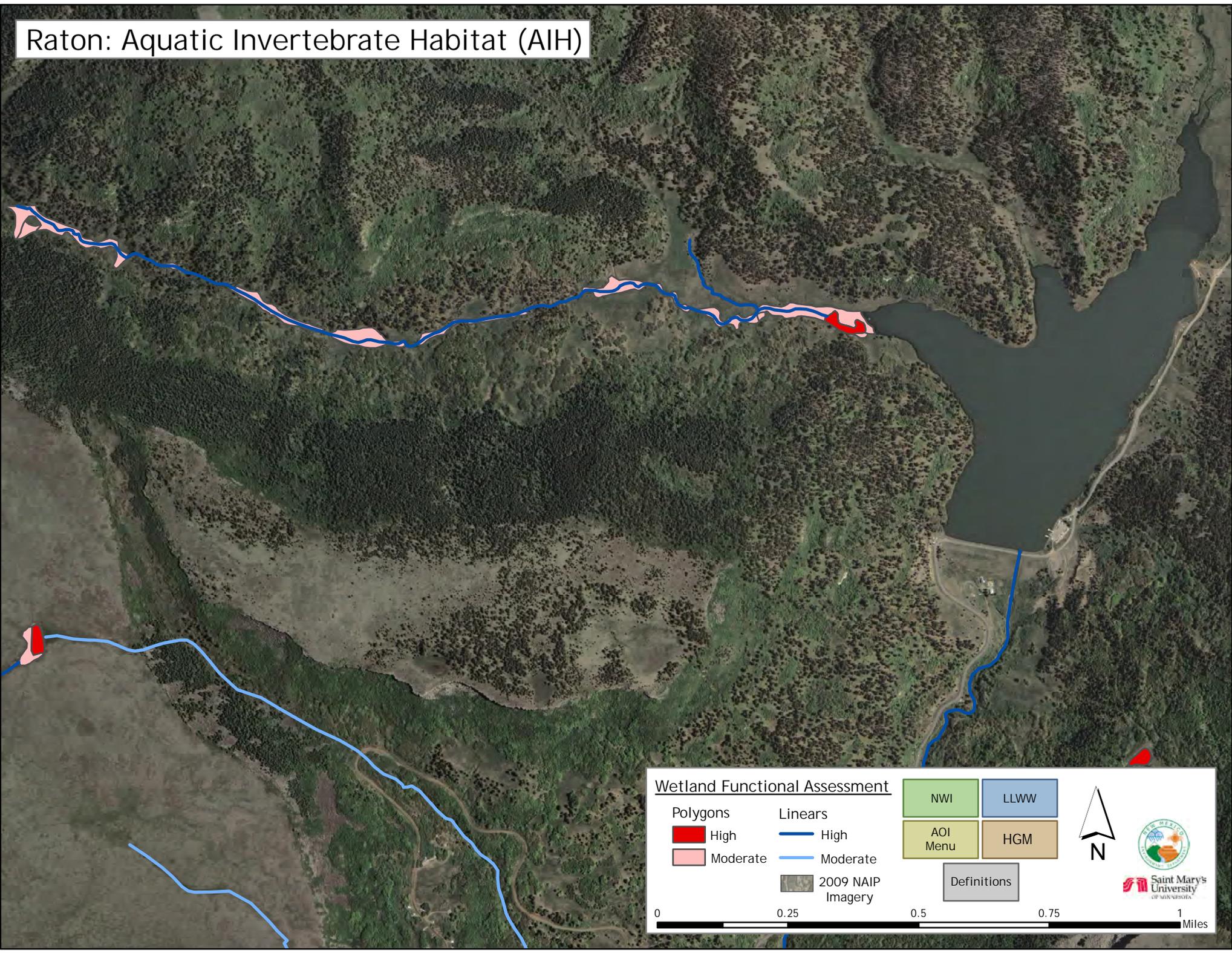



Raton: Hydrogeomorphic Mapping



  	
Polygons <ul style="list-style-type: none"> Depressional Sloped Riverine Lacustrine Fringe Palustrine Fringe 	Linears <ul style="list-style-type: none"> Riverine 2009 NAIP Imagery
AOI Menu LLWW	Definitions NWI
	

Raton: Aquatic Invertebrate Habitat (AIH)



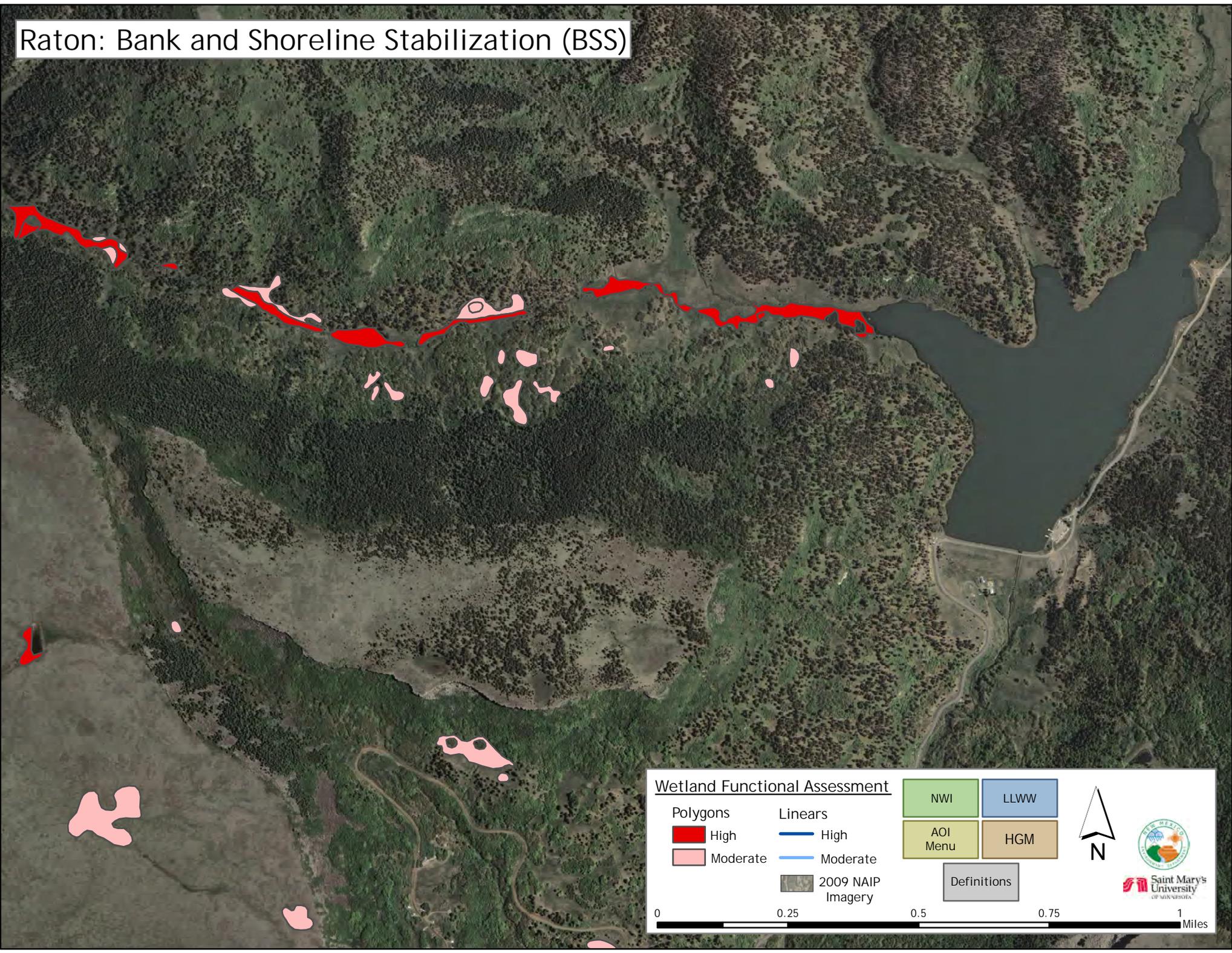
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



Raton: Bank and Shoreline Stabilization (BSS)



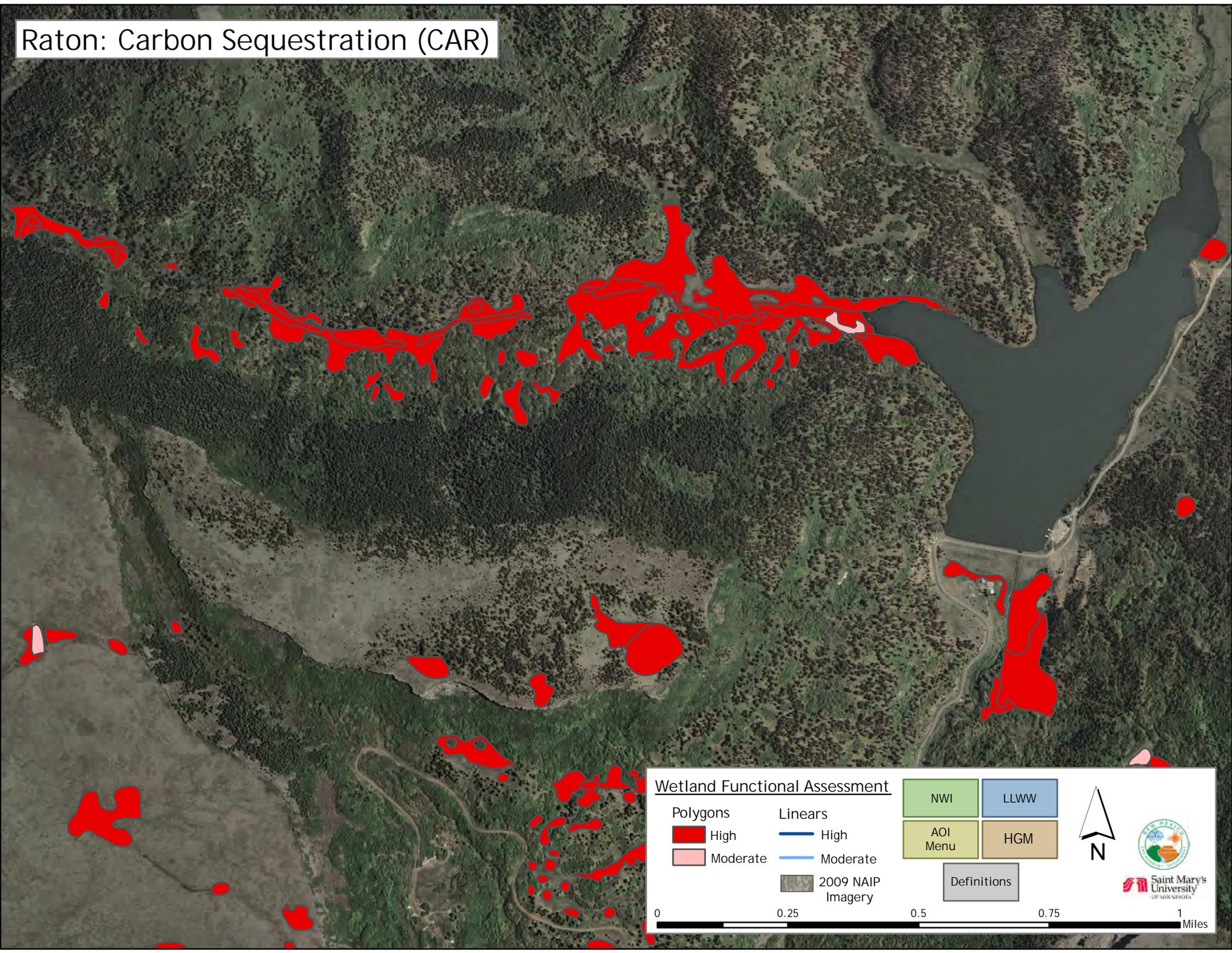
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



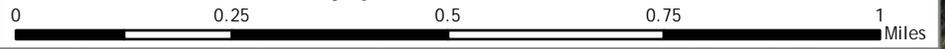
Raton: Carbon Sequestration (CAR)



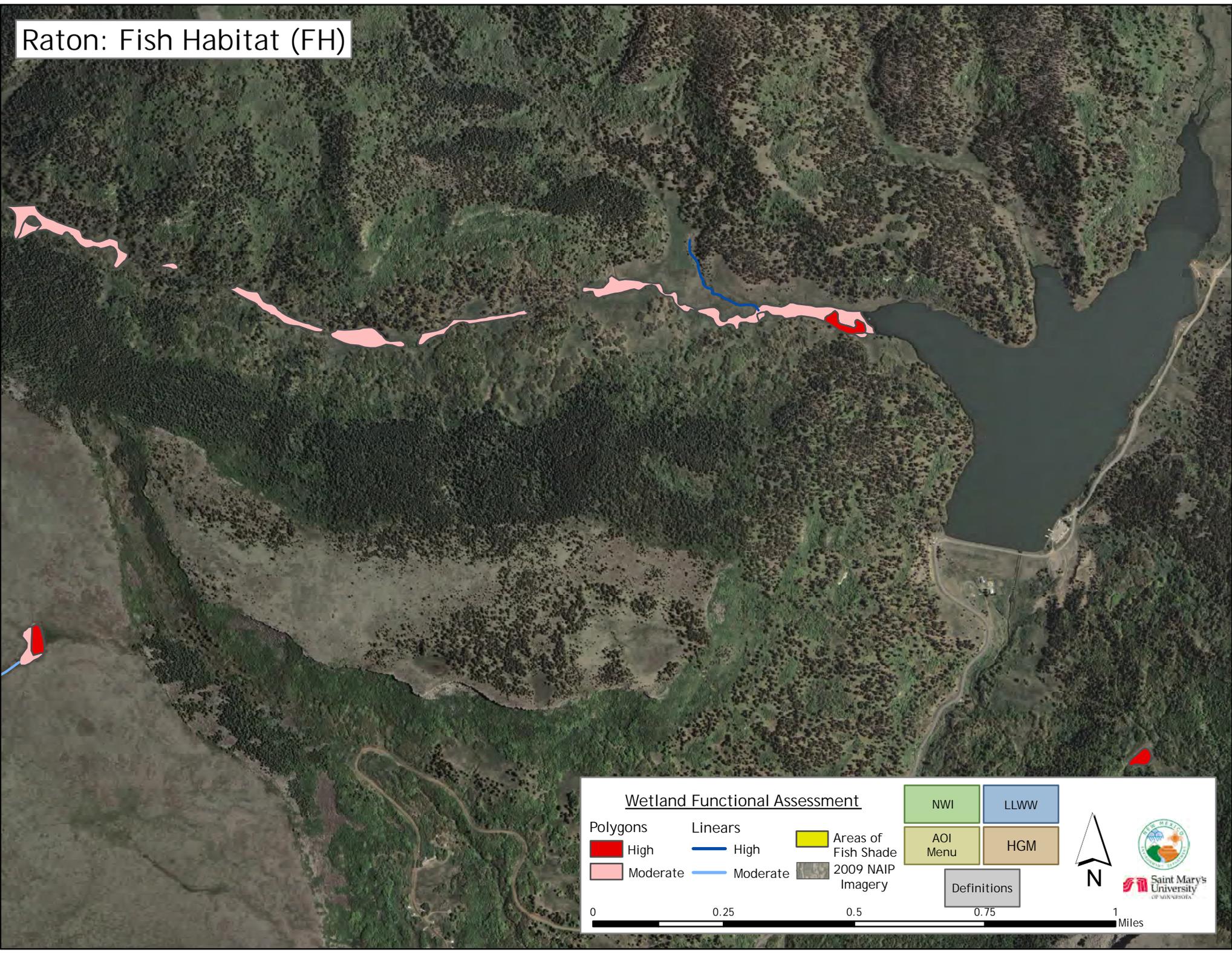
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



Raton: Fish Habitat (FH)



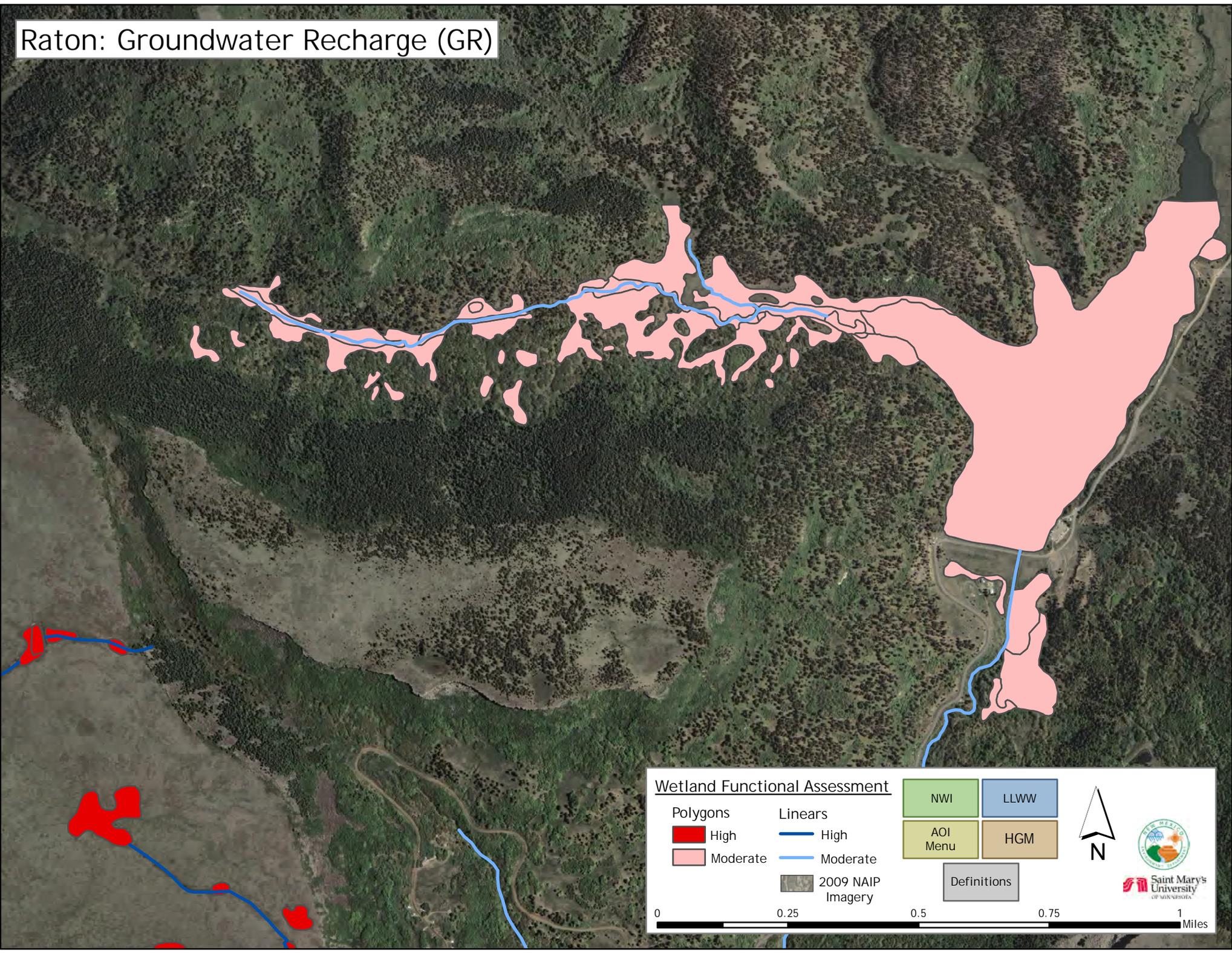
Wetland Functional Assessment

Polygons	Linears	Areas of Fish Shade	NWI	LLWW
High	High	Areas of Fish Shade	AOI Menu	HGM
Moderate	Moderate	2009 NAIP Imagery	Definitions	

0 0.25 0.5 0.75 1 Miles

N

Raton: Groundwater Recharge (GR)



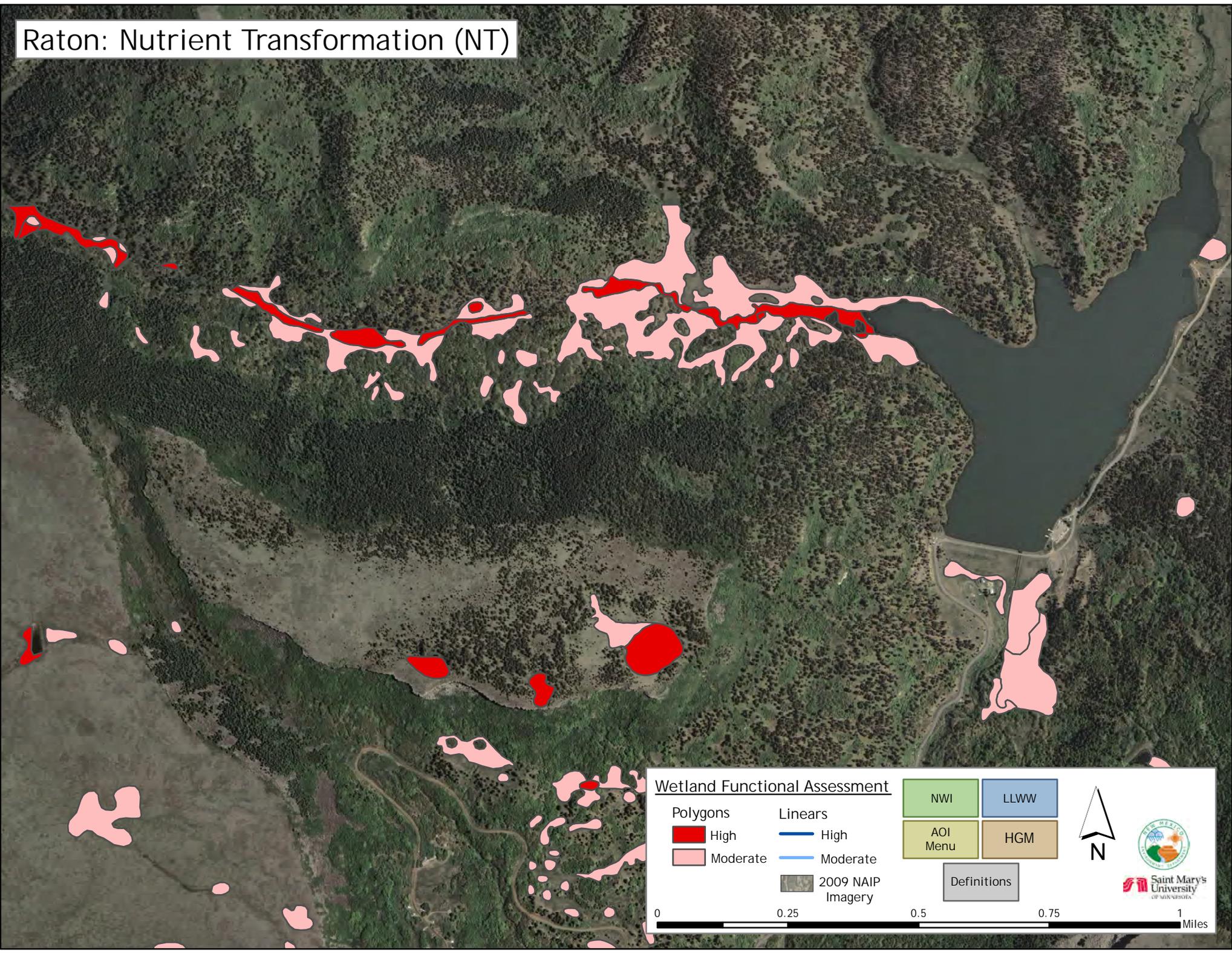
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



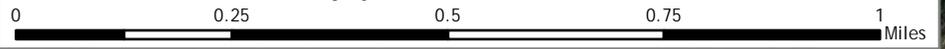
Raton: Nutrient Transformation (NT)



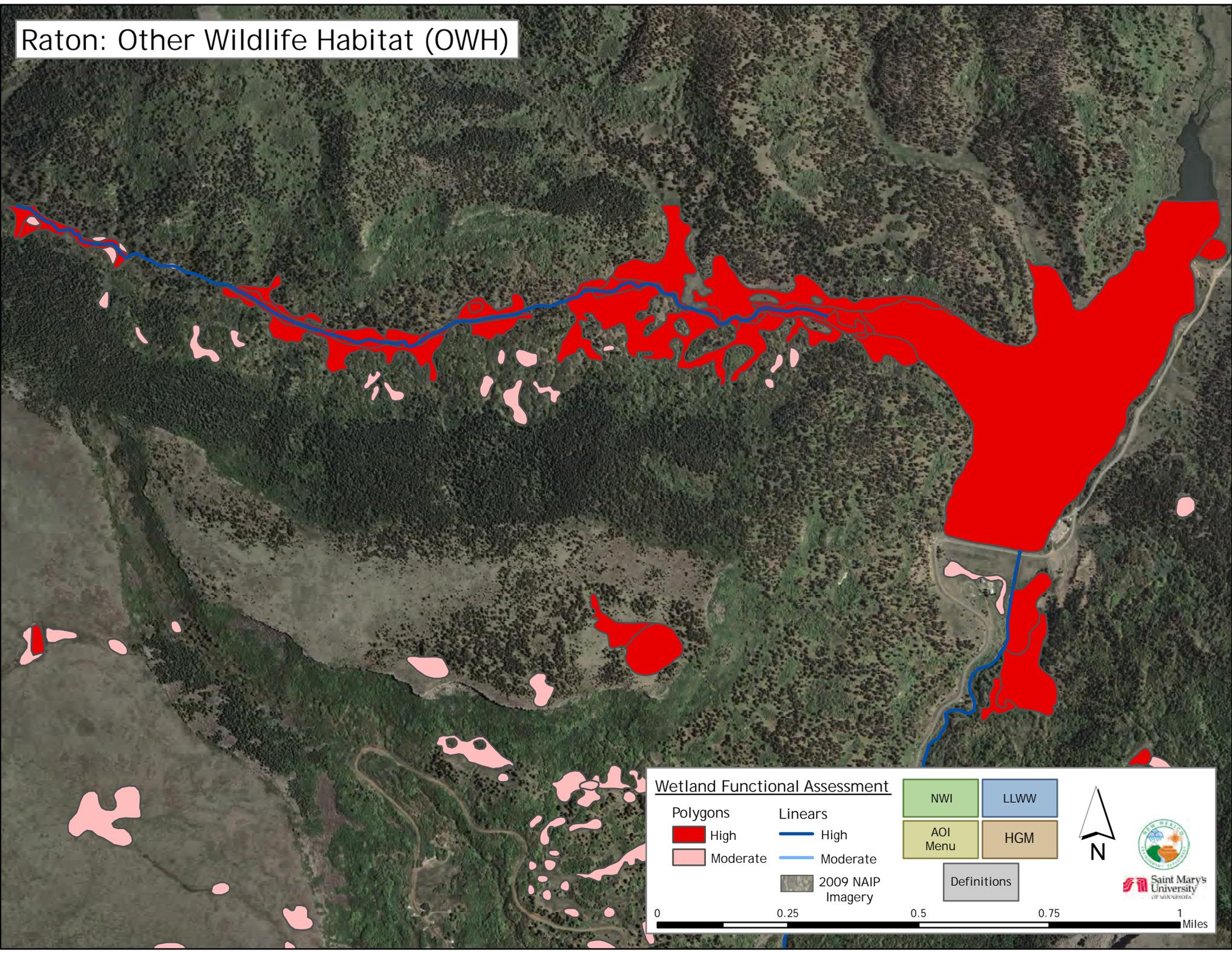
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



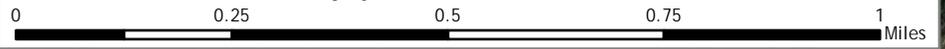
Raton: Other Wildlife Habitat (OWH)



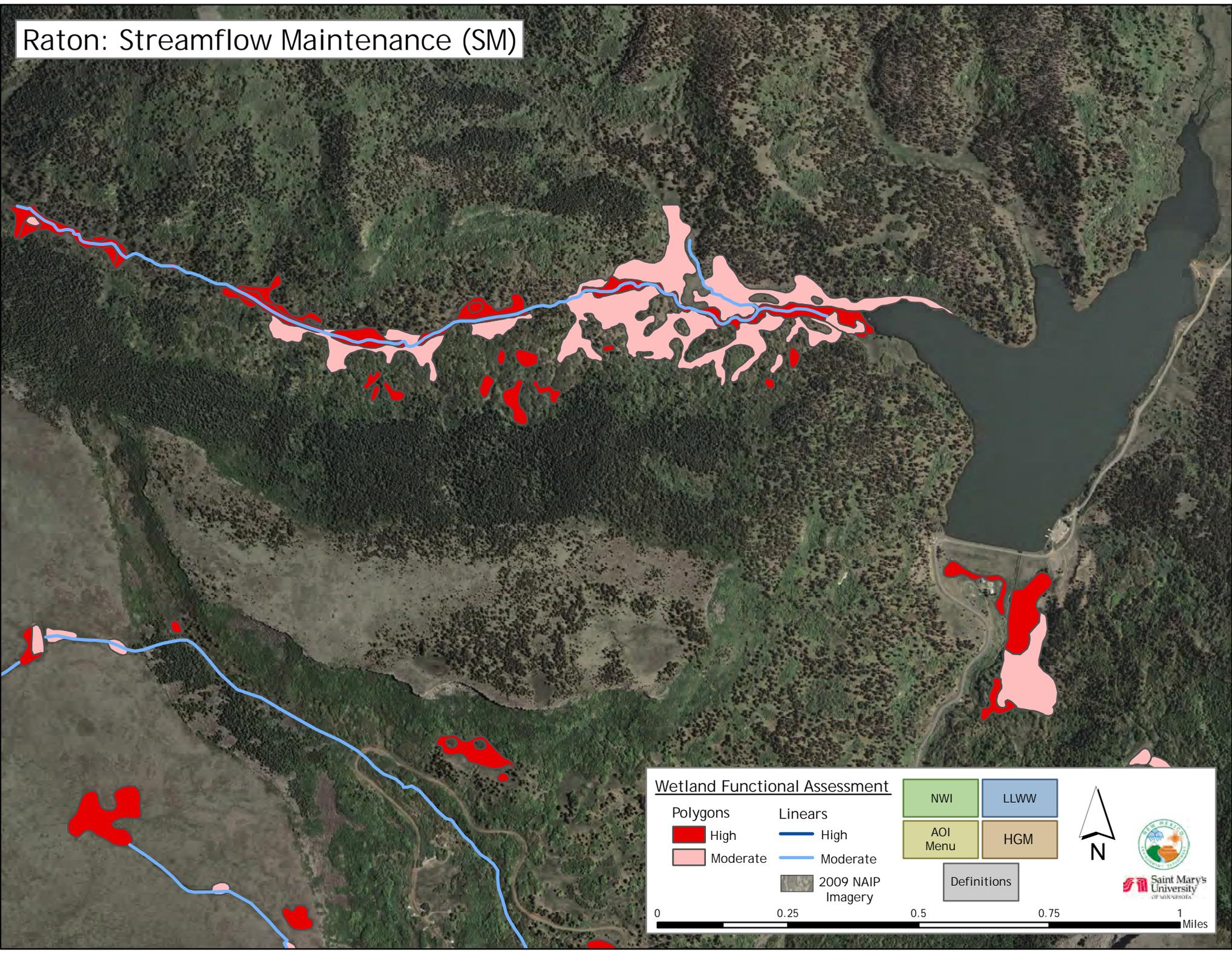
Wetland Functional Assessment

Polygons	Linears
High	High
Moderate	Moderate
	2009 NAIP Imagery

NWI	LLWW
AOI Menu	HGM
Definitions	



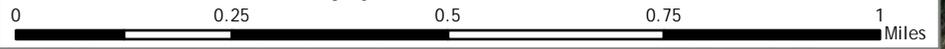
Raton: Streamflow Maintenance (SM)



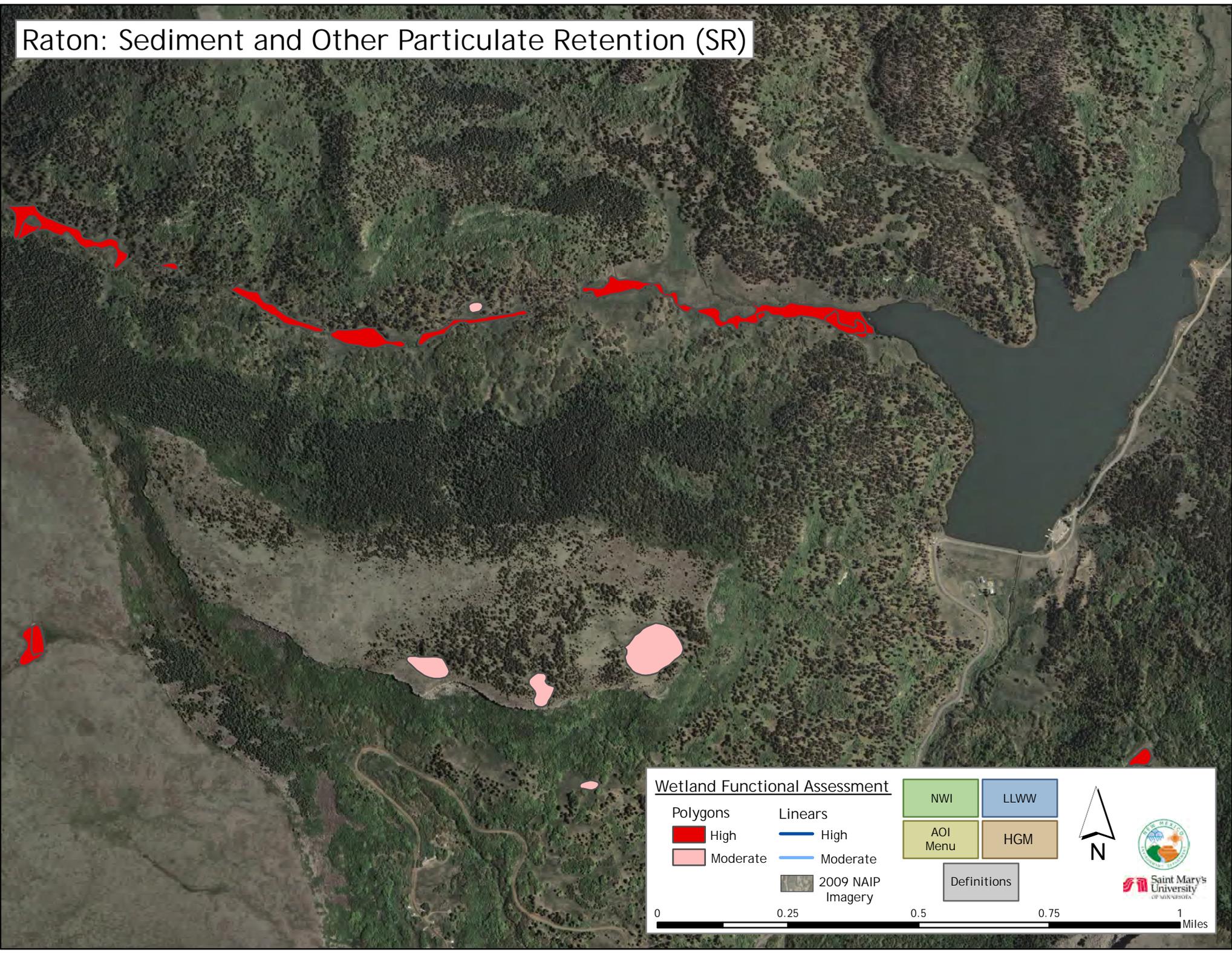
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

- | | |
|-------------|------|
| NWI | LLWW |
| AOI Menu | HGM |
| Definitions | |



Raton: Sediment and Other Particulate Retention (SR)



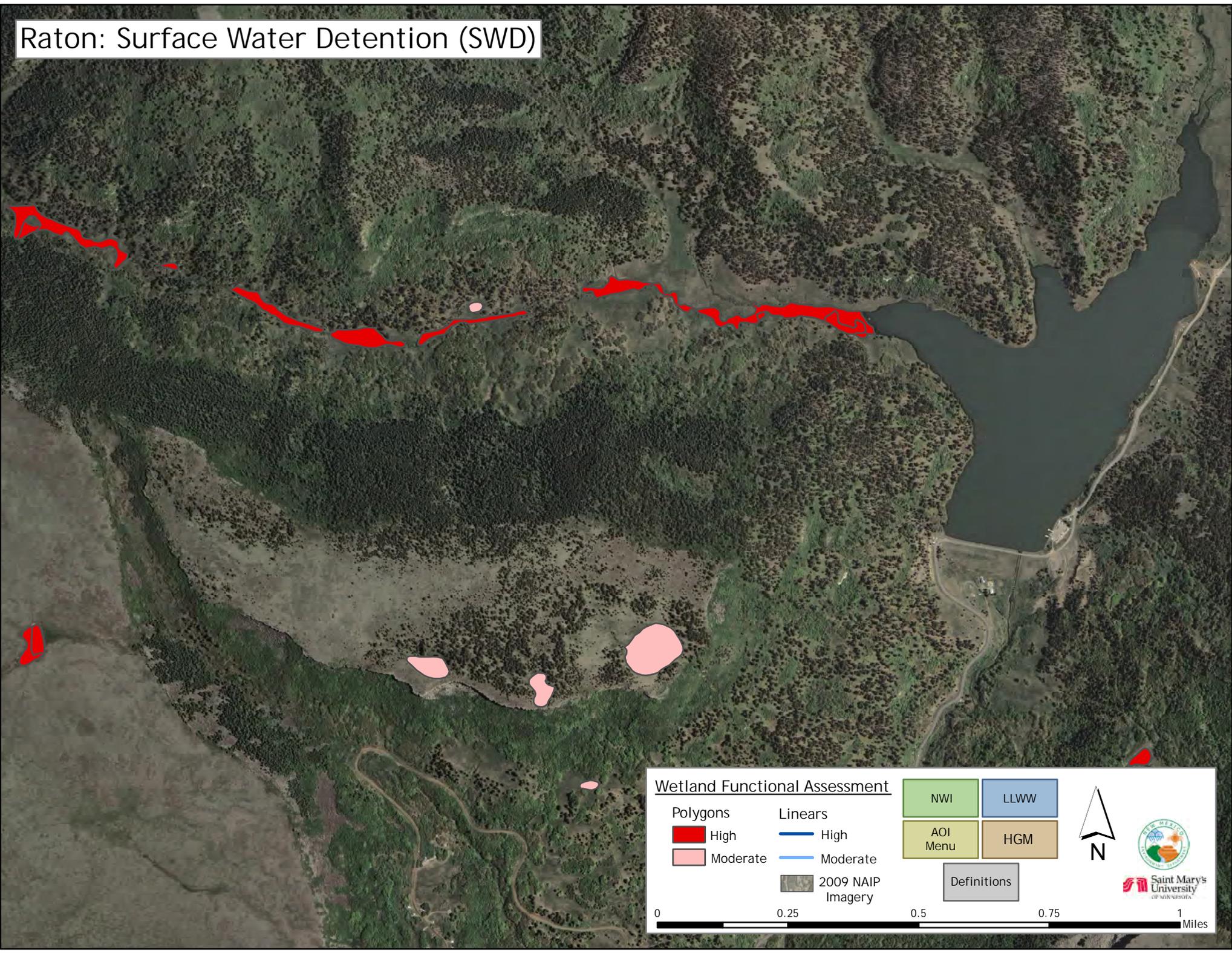
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



Raton: Surface Water Detention (SWD)



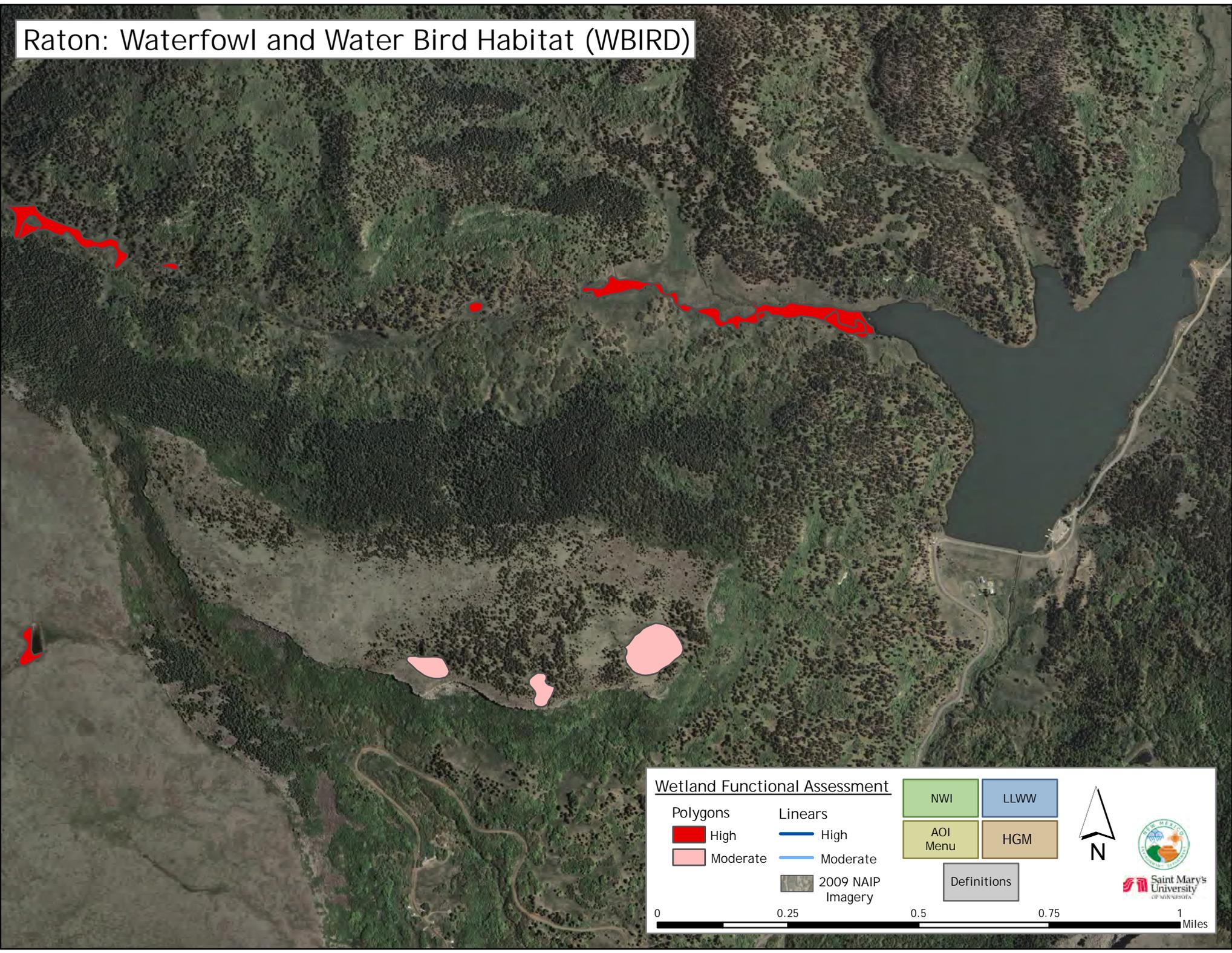
Wetland Functional Assessment

- | | |
|-----------------|-------------------|
| Polygons | Linears |
| High | High |
| Moderate | Moderate |
| | 2009 NAIP Imagery |

NWI	LLWW
AOI Menu	HGM
Definitions	



Raton: Waterfowl and Water Bird Habitat (WBIRD)

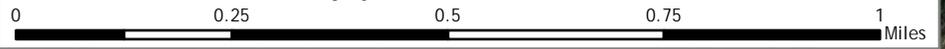


Wetland Functional Assessment

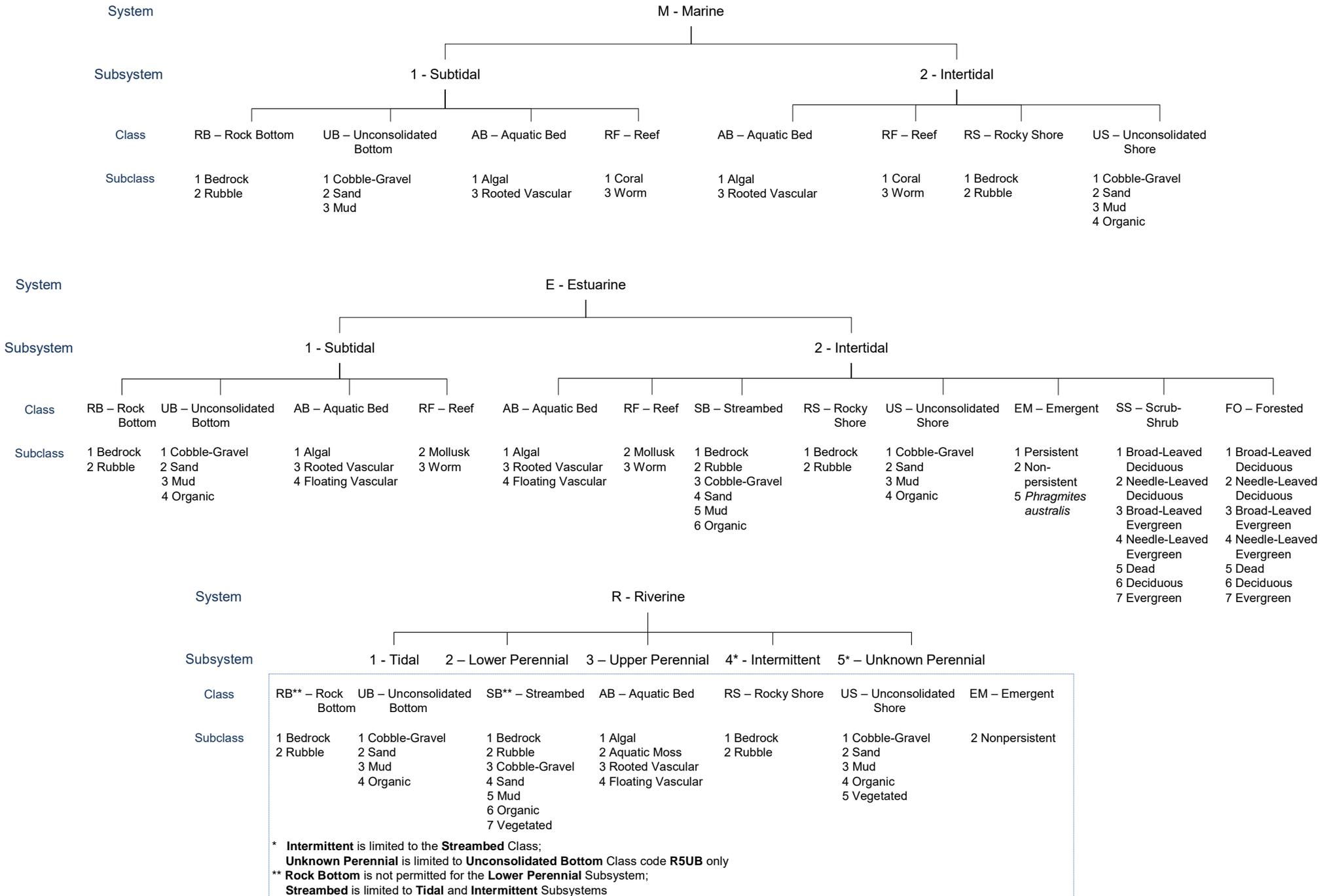
- Polygons**
■ High
■ Moderate

- Linears**
— High
— Moderate
■ 2009 NAIP Imagery

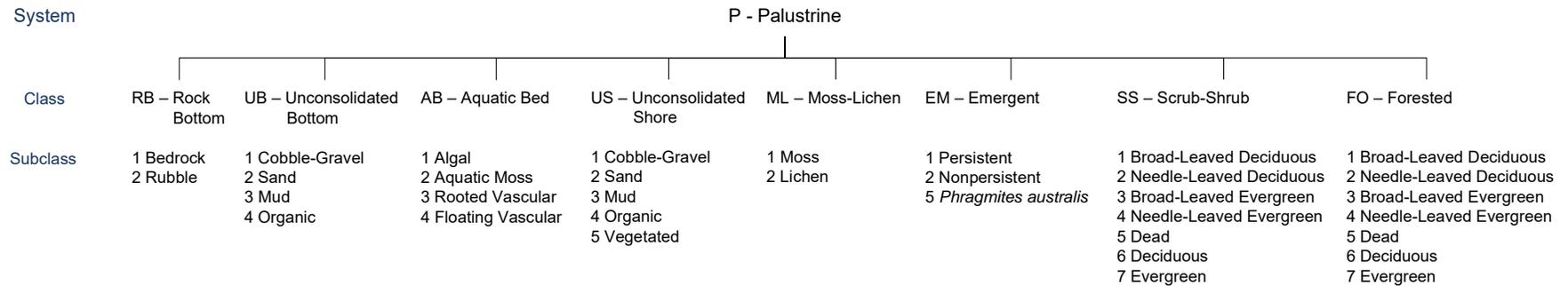
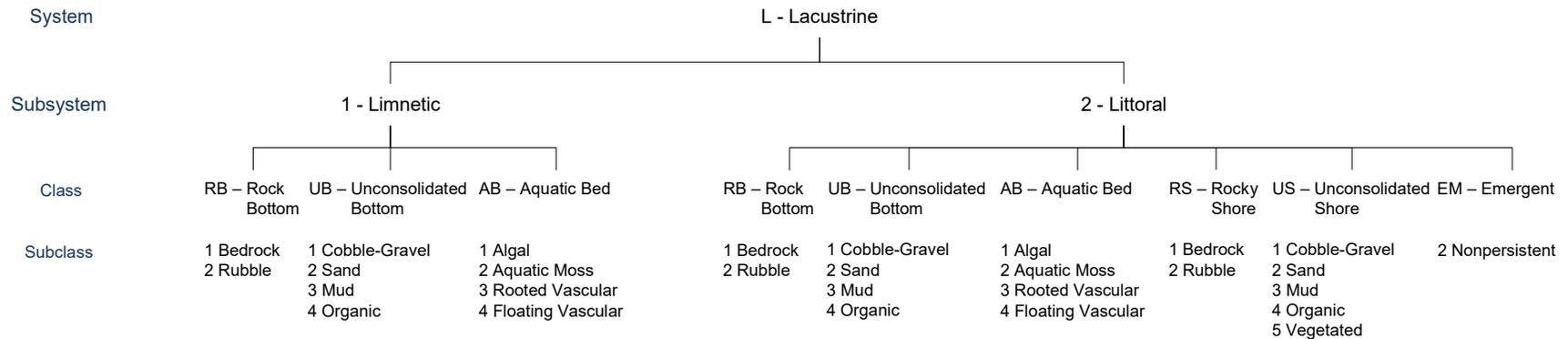
NWI	LLWW
AOI Menu	HGM
Definitions	



WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



WETLANDS AND DEEPWATER HABITATS CLASSIFICATION



MODIFIERS							
In order to more adequately describe the wetland and deepwater habitats, one or more of the water regime, water chemistry, soil, or special modifiers may be applied at the class or lower level in the hierarchy. The farmed modifier may also be applied to the ecological system.							
Water Regime			Special Modifiers	Water Chemistry			Soil
Nontidal	Saltwater Tidal	Freshwater Tidal		Coastal Halinity	Inland Salinity	pH Modifiers for all Fresh Water	
A Temporarily Flooded	L Subtidal	S Temporarily Flooded-Tidal	b Beaver	1 Hyperhaline	7 Hypersaline	a Acid	g Organic
B Saturated	M Irregularly Exposed	R Seasonally Flooded-Tidal	d Partly Drained/Ditched	2 Euhaline	8 Eusaline	t Circumneutral	n Mineral
C Seasonally Flooded	N Regularly Flooded	T Semipermanently Flooded-Tidal	f Farmed	3 Mixohaline (Brackish)	9 Mixosaline	i Alkaline	
E Seasonally Flooded/ Saturated	P Irregularly Flooded	V Permanently Flooded-Tidal	h Diked/Impounded	4 Polyhaline	0 Fresh		
F Semipermanently Flooded			r Artificial	5 Mesohaline			
G Intermittently Exposed			s Spoil	6 Oligohaline			
H Permanently Flooded			x Excavated	0 Fresh			
J Intermittently Flooded				AOI Menu	NWI	NWI Cowardin	
K Artificially Flooded							

Landscape Position, Landform, Water Flow Path, Waterbody Type (LLWW)

Landscape Position (LP)

Lentic (LE)	Lentic Type	
	1	Natural Deep Lake
	a	main body
	b	open embayment
	c	semi-enclosed embayment
	d	barrier beach lagoon
	2	Dammed River Valley Lake
	a	reservoir
	b	hydropower
	c	other
	3	Other Dammed Lake
	a	former natural
	b	artificial
	4	Excavated Lake
	a	quarry lake
5	Other Artificial Lake	
Lotic River (LR) Lotic Stream (LS)	Lotic Gradient	
	1	Low
	2	Middle
	3	High
	4	Intermittent
	5	Tidal
	6	Dammed
	a	lock & dammed
b	run-of-river dam	
c	beaver	
d	other dammed	
7	Artificial (ditch)	
Terrene (TE)		

Landform (LF)

Basin (BA)	
BAaq	aquaculture (created)
BAcr	cranberry bog (created)
BAdm	drowned river-mouth
BAfe	former estuarine fringe
BAfo	former floodplain oxbow
BAff	former floodplain
BAGp	grady pond
BAip	impoundment (created)
BAit	inlet
BAPd	pond
BAPl	playa
BApp	prairie pothole
BAsh	sinkhole
BAwm	wildlife management (created)
BAwv	woodland vernal
Flat (FL)	
FLff	former floodplain
FLfi	former interfluve
Floodplain (FP)	
FPba	basin
FPfl	flat
FPil	island
FPox	oxbow

LLWW Code Examples

TE M BA VR
LP SM LF WF

LS3 M BA TH fg hw
LP SM LF WF OM OM

LK2 M TH
WB SM WF

PD2 P TH hw
WB SM WF OM

Special Modifier (SM)

Montane and High Plain Ecoregion

M Montane Region
P High Plain Region

Water Flow Path (WF)

BI	Bidirectional (nontidal)
IN	Inflow
OA	Outflow (artificial)
OI	Outflow (intermittent)
OP	Outflow (perennial)
OU	Outflow
PA	Paludified
TB	Through flow (bidirectional)
TH	Through flow
TI	Through flow (intermittent)
TN	Through flow (entrenched)
VR	Vertical Flow

Fringe (FR)	
FRbb	barrier beach
FRbi	barrier island
FRdm	drowned river mouth
FRil	island
FRpd	pond
Interfluve (IF)	
IFba	basin
IFfl	flat
Island (IL)	
ILde	delta
ILpd	pond
ILrs	reservoir
Slope (SL)	
SLpa	paludified

Landscape Position, Landform, Water Flow Path, Waterbody Type (LLWW)

Waterbody Type (WB)

Pond (PD)			
1	Natural		
a	bog	g	polygonal
b	woodland (wetland)	h	sinkhole-woodland
c	woodland (dryland)	i	sinkhole-prairie
d	prairie pothole (wetland)	j	Carolina Bay
e	prairie pothole (dryland)	k	pocosin
f	playa	l	cypress dome
		m	vernal-woodland
		n	vernal-West Coast
		o	interdunal
		p	grady
		q	floodplain
		r	other
2	Dammed/Impounded		
a	agricultural	c	commercial
a1	cropland	c1	stormwater
a2	livestock	d	industrial
a3	cranberry	d1	stormwater
b	aquaculture	d2	wastewater
b1	catfish	e	residential
b2	crayfish	e1	stormwater
		f	sewage treatment
		g	golf
		h	wildlife management
		i	other recreational
		o	other
3	Excavated		
a	agricultural	c	commercial
a1	cropland	c1	stormwater
a2	livestock	d	industrial
a3	cranberry	d1	stormwater
b	aquaculture	d2	wastewater
b1	catfish	e	residential
b2	crayfish	e1	stormwater
		f	sewage treatment
		g	golf
		h	wildlife management
		i	other recreational
		j	mining
		j1	sand/gravel
		j2	coal
		o	other

River (RV)	
1	Low Gradient
a	connecting channel
b	canal
2	Middle Gradient
a	connecting channel
3	High Gradient
a	waterfall
b	riffle
c	pool
4	Intermittent Gradient
5	Tidal Gradient
6	Dammed Gradient
a	lock and dammed
b	run-of-river dammed
c	other dammed

Stream (ST)	
1	Low Gradient
a	connecting channel
2	Middle Gradient
a	connecting channel
3	High Gradient
a	waterfall
b	riffle
c	pool
4	Intermittent Gradient
5	Tidal Gradient
6	Dammed Gradient
a	lack and dammed
b	run-of-river dammed
c	beaver dammed
d	other dammed
7	Artificial
a	connecting channel
b	ditch

Lake (LK)	
1	Natural Lake
a	main body
b	open embayment
c	semi-enclosed embayment
d	barrier beach lagoon
2	Dammed River Valley Lake
a	reservoir
b	hydropower
c	other
3	Other Dammed Lake
a	former natural
b	artificial
4	Other Artificial Lake

Other Modifiers (OM)

br	barren	ds	discharge stream	hw	headwater	pi	pond island border
bv	beaver	ed	freshwater wetland discharging directly into an estuary	ip	impounded	ri	river island (wetland associated with a river island)
ch	channelized flow	fg	fragmented	ir	irrigated pasture	sd	surface water-dominated (apply to Water Flow Path Only)
cr	cranberry bog	fm	floating mat	li	lake island (wetland associated with a lake island)	sf	spring-fed
dd	drainage divide	gh	groundwater-dominated (apply to Water Flow Path only)	ow	overwash	ss	subsurface flow
dr	partly drained	hi	severely human-induced				

LLWW Code Examples

TE M BA VR
LP SM LF WF

LK2 M TH
WB SM WF

LS3 M BA TH fg hw
LP SM LF WF OM OM

PD2 P TH hw
WB SM WF OM

Hydrogeomorphic Definitions – Northern New Mexico

Depressional – Wetlands that occur in topographic basins (closed elevation contours) that allow the accumulation of surface water. Water sources include precipitation, ground water discharge, and overland flow, while water may be lost due to evapotranspiration and groundwater recharge.

Artificial – A wetland created or modified by humans.

Impounded – A wetland with an anthropogenic barrier (i.e. dams, roads, berms) designed to purposefully obstruct the flow of water.

Excavated – A wetland where the topological surface has been lowered by an anthropogenic activity.

Natural – A wetland that is created by environmental or geologic processes.

Playa – A wetland that is a dry lake bed that lacks vegetation, and is located at the bottom of a desert basin and is occasionally covered with water.

Inflow – A wetland that receives surface water or groundwater from a wetland or other waterbody at a higher elevation (or lower elevation if pumped in) and has no observable or known significant discharge of surface water to a stream, wetland, or waterbody at a lower elevation.

Outflow - A wetland that receives no surface or ground water inflow (as defined above) from a wetland or permanent waterbody at a higher elevation and exhibits surface or ground water discharged to a stream, wetland, or other waterbody at a lower elevation.

Throughflow – A wetland that receives surface or ground water from a stream, other waterbody or wetland at a higher elevation and has surface or ground water flow out of the subject wetland to a stream, wetland, or other waterbody at a lower elevation; a flow-through system.

Vertical Flow – A wetland that lacks such features as an inlet or outlet and the water table rises and falls within the wetland.

Riverine – Wetlands that occur in floodplains and riparian corridors and are associated with moving water channels. Water sources include; overbank flow from the channel, interflow, tributary inflow, overland flow, and precipitation. These wetlands lose surface water through return of floodwater to the channel and evaporation. Water can also be lost through subsurface discharge to an associated water channel.

Alluvial Fan – An alluvial fan is a triangle-shaped deposit of gravel, sand, or silt that is usually created as flowing water interacts with mountains, hills, or the steep walls of canyons.

Episodic – Riverine wetlands that exhibit no flow at least 76-percent of time.

Subalpine-Alpine – Riverine wetlands (excluding alluvial fan and episodic) that are found within the EPA Level 4 Ecoregions of New Mexico (Apline Zone, Crystalline Subalpine Forests, Grassland Parks, Rocky Mountain Subalpine Forests, Sedimentary Subalpine Forests, and Volcanic Subalpine Forests).

Confined Canyon – These valleys are often narrow and v-shaped, with little alluvial fill, have relatively steep, erosive gradients, move coarse-grained sediments by a high-energy stream with little or no floodplain (Nagel, et. al. 2014). Confined is a modifier to the montane and lowland elevation subclasses of riverine.

Unconfined – These valleys are wider in depositional area than confined valleys. They move larger amounts of alluvial fill and contain broad floodplains that allow active channel migration which supports the development of braiding. Unconfined valleys typically have lower gradients and carry finer-grained sediment (Nagel, et. al. 2014). Unconfined is a modifier to the montane and lowland elevation subclasses of riverine.

Montane – Riverine wetlands (excluding alluvial fan and episodic) that are found within the EPA Level 4 Ecoregions of New Mexico (Crystalline Mid-elevation Forests, Foothill Shrublands, Montane Conifer Forests, Rocky Mountain Conifer Forests, Sedimentary Mid-Elevation Forests, and Volcanic Mid-Elevation Forests).

Lowland – Riverine wetlands (excluding alluvial fan and episodic) that are found within the EPA Level 4 Ecoregions of New Mexico (Canadian Canyons, Canadian/Cimarron High Plains, Conchas/Pecos Plains, Crystalline Mid-Elevation Forests, Mesa de Maya/Black Mesa, Moderate Relief Plains, North-Central New Mexico Valleys and Mesas, Pinyon-Juniper Woodlands and Savannas, Rocky Mountain Subalpine Forests, Rolling Sand Plains, San Luis Alluvial Flats and Wetlands, San Luis Shrublands and Hills, Semiarid Canadian Breaks, Shinnery Sands, Taos Plateau, and Upper Canadian Plateau).

Sloped - Wetlands found in association with the discharge of groundwater and lacks a closed topographic depression of basins.

Headwaters – The source area of a river, the set of streams, wetlands or waterbodies that accumulate to create a river.

Springfed – Wetlands that derive their source from groundwater that wells up to the surface.

Irrigated – A wetland that obtains its primary water from an artificial anthropogenic source, i.e. surface irrigation from an acequia.

Other – This includes all remaining sloped wetlands other than headwaters, springfed, or irrigated subclasses.

Inflow – A wetland that receives surface water and groundwater from a wetland or other waterbody at a higher elevation (or lower elevation if pumped in) and has no observable or known significant discharge of surface water to a stream, wetland or waterbody at a lower elevation.

Outflow - A wetland that receives no surface or ground water inflow (as defined above) from a wetland or permanent waterbody at a higher elevation and exhibits surface or ground water discharged to a stream, wetland, or other waterbody at a lower elevation.

Throughflow – A wetland that receives surface or ground water from a stream, other waterbody or wetland at a higher elevation and has surface or ground water flow out of the subject wetland to a stream, wetland, or other waterbody at a lower elevation; a flow-through system.

Vertical Flow – A wetland that lacks such features as an inlet or outlet and the water table rises and falls within the wetland.

Lacustrine Fringe – Wetlands that are adjacent to lakes (open water greater than 5 acres) and have bidirectional (driven by astronomic tides and wind-driven seiches) water flow. The water elevation of the lake maintains the water table in the wetland.

Palustrine Fringe – Wetlands that are adjacent to ponds (open water 5 acres or less) where the water elevation of the pond maintains the water table of the surrounding wetlands.

Mineral flats – Surficial soil deposits found most commonly on interfluves, extensive relic lake bottoms, or large floodplain terraces where the main source of water is precipitation. These flats are unique because of their poor vertical drainage and lateral drainage because of impermeable layers and low hydraulic gradients.

Organic flats - Surficial soil deposits controlled by vertical accretion of organic matter where water source is dominated by rain. They occur commonly on flat interfluves or depressions where peat can form and water loss is most often from overland flow or seepage to groundwater.

Reference

Brinson, Mark M. 1993. A hydrogeomorphic classification for wetlands. Wetlands Research Program Technical Report WRP-DE-4. Washington, D.C.: U.S. Army Corps of Engineers. 101p.

Nagel, et. al. 2014. A landscape scale valley confinement algorithm: Delineating unconfined valley bottoms for geomorphic, aquatic, and riparian applications. Gen. Tech. Rep. RMRS-GTR-321. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 42p.

Natural Resources Conservation Service (NRCS). 2008. Hydrogeomorphic wetland classification system: An overview and modification to better meet the needs of the Natural Resource Conservation Service. Technical Note No. 190-8-76. Washington, D.C.: U.S. Department of Agriculture. 8p.

Tiner, Ralph W. 2011. Dichotomous keys and mapping codes for wetland landscape position, landform, water flow path, and waterbody type descriptors: Version 2.0. Hadley, MA: U.S. Fish and Wildlife Service, National Wetlands Inventory Project. 51p.

AOI
Menu

HGM

Wetland Functional Assessment Definitions

- Aquatic Invertebrate Habitat (AIH) – provides habitat for aquatic invertebrates,
- Bank and Shoreline Stabilization (BSS) – wetland plants help bind soil to limit or prevent erosion,
- Carbon Sequestration (CS) – serve as carbon sinks that help to trap atmospheric carbon,
- Fish Habitat (FH) – habitat for a variety fish (including a special category containing factors that maintain cold water temperatures for certain species including trout),
- Groundwater Recharge (GR) – sustaining sub-surface water storage and supporting baseflows,
- Nutrient Transformation (NT) – breaking down of nutrients from natural sources, fertilizers or other pollutants; essentially treating the runoff,
- Other Wildlife Habitat (OWH) - habitat for other wildlife (resident and migratory),
- Sediment and Other Particulate Retention (SR) – acting as filters to physically trap sediment particles before they are carried further downstream,
- Streamflow Maintenance (SM) –providing a source of water to sustain streams from drying up during periods of drought conditions or low discharge,
- Surface Water Detention (SWD) – storage of runoff from rain events or spring melt waters which reduce the force of peak flood levels downstream,
- Waterfowl and Water Bird Habitat (WBIRD) – habitat for waterfowl and other water birds,

Robertson, A. G., Stark, K.J., Anderson, J. C., Maffitt, B. L., Rokus, D. D., Hutchins, H.H., 2016. Mapping and Classification for Wetlands Protection: Northeastern New Mexico Highlands and Plains. Saint Mary's University of Minnesota. Winona, Minnesota.

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