



NONPOINT SOURCE SUCCESS STORY

Nebraska

Diverse Efforts Restore Aesthetic Use to Big Indian Reservoir 11A

Waterbody Improved

Big Indian Reservoir 11A is a recreational lake and a flood control structure built in the Big Indian Creek watershed in southeastern Nebraska. The Nebraska Department of Environmental Quality (NDEQ) listed impairments in the reservoir for aesthetic use (sediment) in 2006 and for aquatic life (phosphorus) in 2008. Local stakeholders collaborated to install best management practices (BMPs) in the watershed and renovate the reservoir. Reservoir water quality improved, prompting NDEQ to remove Big Indian Reservoir 11A from the impaired waters list in 2016 for aesthetic impairment due to sedimentation.

Problem

Big Indian Reservoir 11A near Wymore, Nebraska, is a 72-acre impoundment in the Big Indian Creek watershed (Figure 1). Built as a flood control structure, Reservoir 11A is also a popular recreation destination. Since its construction in 1974, sediment accumulating from agricultural runoff and shoreline erosion reduced the storage capacity of the reservoir by 46 acre-feet. Shallower water allowed wave action from wind and power boating to re-suspend sediment and nutrients. High turbidity and algal blooms driven by elevated phosphorus concentrations degraded the aesthetic value of the reservoir and the quality of the fishery. The bottom-feeding habits of rough fish (species less desirable for sport) further exacerbated the resuspension of sediment and nutrients into the water column.

NDEQ listed the reservoir as impaired for aquatic life impairment due to excess phosphorus in 2006 (4,423 pounds per year [lbs/yr] estimate) and for aesthetic use impairment due to sediment accumulation in 2008 (8,050 tons per year [tons/yr] estimate). The reservoir's 3,470-acre (ac) watershed is 70 percent grassland and 25 percent cropland. Although much of the loading to the reservoir likely occurred from intensive cultivation of cropland in the past, recent nutrient and sediment loading still exceeded sustainable levels. Internal recycling was the source of nearly half the pollutant loads within the reservoir. Restoring the aesthetic use benefit required removing the accumulated sediment. In 2009 NDEQ wrote a combined total maximum daily load (TMDL) for phosphorus and sediment for the reservoir, limiting phosphorus loading to 573 lbs/yr and sediment loading to 5,429 tons/yr.



Figure 1. Big Indian Reservoir 11A is about 4 miles north of the Nebraska/Kansas state line.

Project Highlights

Local stakeholders developed a watershed management plan in 2009 to improve water quality in the reservoir. From 2009 to 2013, the project sponsors led efforts to renovate the reservoir and install multiple cropland, pasture and stream BMPs:

- **Cropland Practices:** Conservation tillage (130 ac), cover crops (343 ac), five grade control structures, grass waterways (6 ac), 10 sediment control structures (controlling 464 ac), terraces (96,784 linear feet [ft] controlling 725 ac), and wetland rehabilitation (1 ac).
- **Pasture Practices:** 12 alternative water supply, exclusion fencing (21,014 ft), invasive species control (130 ac), and prescribed grazing (728 ac).

Table 1. Pollutant load reduction to Big Indian Reservoir 11A relative to TMDL limits.

Pollutant	Pre-project Load (2007 est.)	Post-project Load (2013 est.)	Percent Reduction Achieved	TMDL Load Limit	Percent Reduction Required by TMDL
Sediment (tons/yr)*	8,050	2,229	72.3	5,429	32.6
Phosphorus (lbs/yr)**	4,423	1,277	71.1	573	87.0

* Sediment load reductions were based on 1995 and 2007 bathymetric surveys. Storage volume loss over 12 years was converted to tons of sediment per year delivery.

** Phosphorus load was estimated by BATHTUB/CNET from 1997–2007 nutrient and flow data.

- **Stream Practices:** Riparian zone grass planting (13 ac), three main stem sediment/nutrient basins, riparian zone shrub and tree planting (400 ft), and wetland/floodplain reconnection (8 ac).
- **Recreation Area Practice:** Camper dump station.
- **In-Lake Practices:** Bio-engineered and rip-rap shoreline stabilization (570 ft), sediment removal (277,490 cubic yards), and nine shoreline breakwaters.
- **Other:** On-site wastewater system upgrade.

Cropland practices effectively reduced runoff of sediment and nutrients. Removing cattle from the stream with pasture practices in turn allowed renovation of the riparian zone through grass and tree plantings. Along with strategic reconnection to streamside wetlands, these improvements helped stabilize the stream banks and increased the watershed’s capacity to assimilate pollutants.

Renovating the reservoir consisted of removing sediment; stabilizing the shoreline with offshore breakwaters, jetties and armoring; constructing inlet sediment and nutrient traps; and removing rough fish. The Nebraska Game and Parks Commission (NGPC) restocked the reservoir with bass, bluegill and channel catfish after the reservoir volume recovered. Continuing outreach efforts focus on generating support among local landowners to improve and protect the reservoir from runoff pollution.

Results

The reservoir now supports a robust warm water fishery, and recreational visitations have increased. Land treatments and renovation of the reservoir reduced loading of nitrogen, phosphorus and sediment (Table 1). Excavating accumulated sediment and stabilizing the shoreline reduced sediment loading significantly below the TMDL limit and removed the

cause of the aesthetic impairment. Project activities significantly reduced phosphorus loading, but fell short of achieving the TMDL limit. The reservoir was reclassified from category 4a to category 4r, indicating a renovated lake, in the 2014 Nebraska Integrated Report. NDEQ removed the reservoir from the state’s list of impaired waters for aesthetic use impairment in the 2016 Nebraska Integrated Report, but the overall assessment as category 4r was retained. Protocol requires that NDEQ collect nutrient data through 2018 and then re-assess aquatic life impairment due to nutrients (i.e., reconsider 4r categorization). Therefore, the reservoir remains listed as impaired due to phosphorus.

Partners and Funding

The Lower Big Blue Natural Resources District (LBB NRD) led the implementation of the Big Indian 11A Lake Watershed Management Plan in collaboration with NDEQ, NGPC, Nebraska Cooperative Extension and the U.S. Department of Agriculture’s Natural Resources Conservation Service (NRCS). The Nebraska Environmental Trust (NET) provided additional support. NRCS Environmental Quality Incentives Program (EQIP) funds solely supported installation of agricultural practices, while NGPC funds solely supported in-lake practices.

Other partners shared costs for both upland and in-lake practices. Total costs for the project (\$1,742,114) were shared: NDEQ (\$749,025: CWA section 319), NGPC (\$168,000: Sport Fishery), NRCS (\$306,495: EQIP), LBB NRD (\$54,063), NET (\$383,206) and private landowners (\$81,325). Nebraska Cooperative Extension provided outreach support through mailings, personal contacts and field tours to promote adoption and proper management of conservation practices.



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