

# Audio Commentary for N-CORPE Augmentation Project Video

## Chapter 1

### Audio 01

N-CORPE. The Nebraska Cooperative Republican Platte Enhancement Project. In this video, we'll refer to it as NCORPE, or simply the Project. NCORPE is a water Augmentation Project situated in the south-central portion of Lincoln County about 15 miles south of North Platte, Nebraska.

### Audio 02

The Project is designed to pump groundwater into a pipeline where it will be discharged as streamflow to Medicine Creek, a sub-basin of the Republican River, a watershed that drains almost 25,000 square miles to its confluence with the Smoky Hill River in northeastern Kansas, forming the Kansas River. These flows eventually drain into the Missouri River.

### Audio 03

Medicine Creek is a baseflow dominated stream that rises from the base of the Sandhills and courses roughly 70 miles before discharging into the Republican River near Cambridge, Nebraska. The major components of the Project are in the upper portion of the Medicine Creek sub-basin.

### Audio 04

For reference, The Rock Creek Augmentation Project developed by the Upper Republican NRD is approximately 70 miles southwest of N-CORPE.

### Audio 05

N-CORPE is an interlocal agency consisting of four member natural resource districts or NRDs. The Upper Republican, Middle Republican, Lower Republican, and Twin Platte NRDs comprise the membership of N-CORPE.

### Audio 06

The Project lies within the boundaries of two member NRDs, Twin Platte and Middle Republican.

## Chapter 2

### Audio 07

The Project's wellfield is located on the boundary of the surface water divide of the Platte and Republican Rivers shown here in green.

### Audio 08

The boundary of the Twin Platte and Middle Republican NRDs is shown here in yellow.

#### Audio 09

In this video we'll take a virtual tour of the Project, along with viewing portions of Medicine Creek, starting at the upper end of the Project and working downstream. This virtual tour uses imagery from a variety of sources, including Google Earth, video from aerial flyovers, and photos and video taken from the ground level. We'll start with this short flyover heading east toward the Project headquarters, where equipment and materials used to maintain the Project infrastructure are stored.

#### Audio 10

The N-CORPE Augmentation Project is designed to offset depletions to streamflow to the Republican River Basin by reducing the consumptive use of water used to irrigate crops, and pumping water directly into Medicine Creek as streamflow.

#### Audio 11

The Project includes a total of 19,500 acres of which 15,800 are certified irrigated acres. The Project lands included 114 irrigation wells and center pivots that previously delivered water to crops. The NRD boundaries and basin divide are shown here in yellow and green, respectively.

#### Audio 12

With the exception of 1,912 acres, circled here in blue, all the acres will be retired from irrigation. The remaining center pivots and supporting equipment have already been sold off and removed or are in the process of being removed.

### Chapter 3

#### Audio 13

The Augmentation Project consists of 30 groundwater wells represented here by the blue dots. This well field will pump groundwater into a main transmission pipeline and deliver water directly to the upper portions of Medicine Creek where it will become streamflow. The main transmission pipeline to Medicine Creek, highlighted here in red, is just short of 6 miles in length and is 42-inches in diameter.

#### Audio 14

While still in the final planning and design stages, the Project will also have the capacity to discharge water in a pipeline north toward the Platte River for water management.

#### Audio 15

A time lapse of construction activities for the collector pipeline within the well field demonstrates how construction progressed. This pipeline will aggregate well discharges bringing them toward the main transmission pipeline. This is also a good view of the sandhills where the Project well field is located.

#### Audio 16

This view shows the pipeline network within the wellfield and the main transmission line heading toward Medicine Creek, the upper portion of the pipeline is highlighted here in yellow.

#### Audio 17

The system design allows for a pumping capacity of about 60,000 acre-feet per year, or around 83 cubic feet per second at a constant rate of pumping. Within the augmentation plan proposed by Nebraska, pumping rates would vary depending on the type of operations needed for a given year. In years in which augmentation pumping is needed to ensure compliance with the Republican River Compact, referred to as Compact Operations Years, pumping could range from zero to 60,000 acre-feet per year. In other years, referred to as State-Based Operations, smaller pumping rates of about 1,800 acre-feet per year may be made.

#### Audio 18

Careful monitoring of pumping rates and volumes will be conducted in real time by NCORPE staff using a Supervisory Control and Data Acquisition, or SCADA system. An example of the type of data the SCADA system collects is the amount of water pumped from the wellfield and discharged to Medicine Creek or the Platte River. Here, we see a screen shot of the interface for the SCADA system.

### Chapter 4

#### Audio 19

We pause here to observe some additional video. Here we see the main transmission pipeline being installed. As you can see, the speed of the construction crew is quite impressive.

#### Audio 20

Let's continue our tour and move south to the Project discharge. Here, water flows out of the pipe, and then through an energy dissipater – a structure designed remove the powerful forces of the water exiting the pipeline.

#### Audio 21

This structure will minimize potential erosion of this new streamflow as it enters the creek channel and flows downstream. Here at the discharge we see a picture of the outlet structure and a view of the channel downstream of the outlet looking to the east.

#### Audio 22

High groundwater levels were encountered at the intersection of the Project pipeline and a regional natural gas pipeline. This groundwater required dewatering for the pipe installation to be completed. The dewatering area was approximately a quarter mile upstream of the Project outlet.

#### Audio 23

The dewatering discharge was on the order of 200 gallons per minute, or less than ½ cubic feet per second. Even this small discharge, approximated by this blue line, found its way to the channel that the pipeline discharges to and continued to progress downstream before dewatering activities ceased.

#### Audio 24

Groundwater in the area of the Project outlet is near the ground surface. Less than 100 feet upstream of the Project outlet, groundwater had infiltrated into a concrete vault that will house the outlet flow

meter. We see in this video from February 3, 2014, that the vault had filled with groundwater and was beginning to overtop the open flange fitting for the flow meter, flowing into the discharge pipe itself.

## Chapter 5

### Audio 25

This video downstream of the outlet shows some of the dewatering flow that was in the channel at the time of the visit. As we pan from west to east we see the channel of Medicine Creek.

### Audio 26

The Republican River Compact Administration, or RRCA, has adopted a groundwater model that covers a portion of the states of Nebraska, Kansas, and Colorado. The RRCA Model grid is divided into one square mile cells. This square mile cell, here in orange, is shown in its relation to the Project outlet.

### Audio 27

The Model is a useful and practical tool and serves an important function to the RRCA. However, it is just a representation of the physical system and at a coarse scale of one-mile grid cells. The Model can't replace actual streamflow measurement and site observation information.

### Audio 28

Leaving the Project outlet we move into the Medicine Creek valley where the Sandhills begin to give way to the loess mantled Great Plains.

### Audio 29

For the remainder of this virtual tour, we will look at six locations where streamflow information was obtained by the Nebraska Department of Natural Resources, or DNR. We will also examine three additional sites in the lower reach of Medicine Creek.

### Audio 30

First, we'll turn to Site 1, located about 5 miles downstream from the Project outlet. This location is at the bridge on Darnell Road downstream from the headwaters of Medicine Creek.

## Chapter 6

### Audio 31

First we look downstream on the creek, viewing the channel from the top of the bridge. From this footage, taken on January 16, 2014, we can see the flows moving south downstream through a small but well defined channel. The same view from a few weeks later is similar, with streamflow in this upstream reach moving to the south.

### Audio 32

The view upstream at the same location provides additional information about the nature of baseflow in Medicine Creek which is born of seeps and springs. Here, those seeps are clearly visible and provide evidence of groundwater discharging into the creek. Looking more closely at this particular seep, with this video taken from a few weeks earlier, the small but established discharge is easily observed.

#### Audio 33

Streamflow measurements were made by DNR staff on two separate occasions, each of which fell between the dates on which the videos were taken. The measured data indicated streamflow of around one and a half cubic feet per second for both days.

#### Audio 34

Moving on from Site 1, we'll go downstream about another 5 miles to the southeast, to Site 2. First, however, we'll make a quick detour just a short distance downstream from Site 1, at the bridge crossing at West Medicine Road.

#### Audio 35

This location is important because it provides another visible example of groundwater discharge becoming streamflow in Medicine Creek. Here groundwater not only discharges via seeps from the banks of the stream but pressure heads cause groundwater to discharge into the streambed.

#### Audio 36

As shown in this close-up video, groundwater can be seen discharging up through the streambed near the culvert entrance. This discharge under pressure results in the streambed liquefying. You might think of it as "quicksand" where basically the soil in the streambed loses its ability to support weight because the upward flowing groundwater discharging into the stream suspends the soil particles. This presented a challenge and modification of the culvert installation methods.

### Chapter 7

#### Audio 37

Now we'll move on to Site 2. At this site, some one and a half miles northwest of Wellfleet, Nebraska, another bridge crosses Medicine Creek as it flows to the southeast. Looking upstream at this location, it's already apparent that the size of the channel has increased, along with the flow.

#### Audio 38

Similar conditions were observed at both periods during which the video was recorded. Turning downstream at the same bridge location Medicine Creek flows southeast. Comparable conditions were observed on January 16.

#### Audio 39

This site provides yet another excellent example of the gaining nature of the creek, and the real world conditions that define the interaction between the ground water and the surface water flows in the creek. Seeps can be clearly seen on the west, or right bank, of Medicine Creek, entering the channel just upstream of the bridge crossing.

#### Audio 40

As shown here, the groundwater spills out of this bottomless stock tank, flowing out toward the creek channel. Total creek streamflows here were also measured by the DNR, and showed streamflow slightly less than 9 cubic feet per second, up from the one and a half cubic feet per second observed upstream at Site 1.

#### Audio 41

As we follow the seep flows to the main creek channel, we see Medicine Creek again, just upstream from the bridge at Site 2.

#### Audio 42

Moving downstream, it's only a short distance to Wellfleet Lake, located just to the west of Wellfleet, Nebraska. The reservoir has a surface area of about 50 acres at normal elevations, and holds about 270 acre-feet of storage content. Wellfleet Lake is a recreational facility for the area and is owned by the Nebraska Board of Educational Lands and Funds and is leased by the Wellfleet Community Club. Wellfleet Dam is on the southeast end of the lake, a quarter mile from town.

### Chapter 8

#### Audio 43

From the top of the dam, looking northwest across Wellfleet Lake, we can see the top of the outlet structure, and out across the lake surface. Turning around to look southeast, Medicine Creek streamflow passes through the small reservoir, making its way downstream. Here the view and flow appear similar in this later video taken on February 3.

#### Audio 44

Leaving Wellfleet Dam and Lake, we'll continue to move downstream on Medicine Creek, turning next to a location about half a mile south of Wellfleet, at a bridge crossing on Niles Road. From this spot at Site 3, located a little over 2 miles downstream from Site 2, we first look upstream to the west on Medicine Creek.

#### Audio 45

As the camera pans slowly downstream, we again see signs of the gaining nature of the creek. Seeps on the right bank can be seen here, discharging into the creek and boosting overall creek discharge.

#### Audio 46

Now as we turn toward the downstream face of the bridge, we see the results from gaging measurements taken here, which again reflect gaining conditions, with streamflow right around 13 cubic feet per second for both measurements. The channel width has also gradually increased from the upstream site locations, as the stream continues on to the southeast.

#### Audio 47

We move on from Site 3, to the next observation point located about 16 miles downstream, as Medicine Creek turns more easterly away from Highway 83. Site 4 is near a bridge crossing on Highway 23, about halfway between Maywood and Curtis, Nebraska.

#### Audio 48

First we'll view the site looking upstream to the north, using video taken on January 16, 2014. This footage, taken at ground level just upstream from the bridge, provides a good vantage point to observe

the bank conditions and a channel reflecting increased streamflow conveyance capacity as we move downstream.

## Chapter 9

### Audio 49

Stream gage measurements taken here by DNR staff show streamflow of around 23 or 24 cubic feet per second, continuing a roughly linear rise from the flow rates observed at upstream sites. Turning downstream, Medicine Creek flows under the Highway 23 Bridge and to the south before turning again to the east, continuing its track toward the Republican River.

### Audio 50

From Site 4, the next observation point in this video is located approximately 5 miles to the east-southeast. Site 5 is located about a quarter mile south of Curtis, Nebraska, at the Highway 18 bridge crossing.

### Audio 51

First, let's examine conditions looking upstream on Medicine Creek, again viewing the channel from ground level, just to the west of the bridge. Measurements taken here by DNR staff indicated streamflow of a little over 27 cubic feet per second, again increasing as we move downstream.

### Audio 52

Panning around from the west to the south, and then eventually to the east, the gaining flows in Medicine Creek continue under the Highway 18 bridge, later turning southeast.

### Audio 53

Leaving Site 5, we move downstream a little over 14 miles southeast. Site 6 is located about a half mile east of Stockville, Nebraska, again on Highway 18. From this site we'll start with the view upstream to the north, looking from the top of the bridge.

### Audio 54

The channel width has increased again from the upstream sites, and the creek from this location is roughly 10 miles upstream from the upper portions of Harry Strunk Reservoir.

## Chapter 10

### Audio 55

Measurements taken here by DNR on January 21, 2014, showed streamflow of over 40 cubic feet per second, about 14 cubic feet per second higher than the flows upstream at Site 5. Turning toward the downstream face of the bridge, Medicine Creek flows south as it continues its journey toward its confluence with the Republican River.

### Audio 56

Having now observed sites along the upper and middle portions of Medicine Creek drainage basin, we can now turn toward the lower portion of the watershed, focusing on three fixed gaging stations. The

first two stations are located upstream and downstream of Harry Strunk Reservoir – a reservoir managed by the U.S. Bureau of Reclamation.

#### Audio 57

First we'll look at the upper gaging station, located roughly 6 miles upstream from the upper portions of Harry Strunk Reservoir. This station (DNR06841000), formerly managed by the U.S. Geological Survey, is now owned and operated by the Nebraska Department of Natural Resources.

#### Audio 58

The gaging station itself can briefly be seen here. Turning back to the creek channel, the camera pans from the southwest, looking upstream on the channel, slowly around to the northeast, downstream. The channel here has increased in width as compared to upstream.

#### Audio 59

Downstream from the gaging station we move to Harry Strunk Reservoir, and its associated Medicine Creek Dam. Flows from this facility are for irrigation, flood control, and other purposes.

#### Audio 60

Just downstream from the dam, DNR maintains at their cost another important gaging station. This gage, DNR06842500, is the RRCA compact accounting gage for the Medicine Creek Subbasin.

### Chapter 11

#### Audio 61

Streamflow data collected at this gage is used for water use and allocation calculations made for the Republican River Compact. Streamflows are measured at the gaging station located on the right, or west bank, of Medicine Creek. Streamflow at this gage is directly affected by operations of the dam outlet works.

#### Audio 62

From here, Medicine Creek travels along its final reach, flowing south toward its confluence with the Republican River near Cambridge, Nebraska, roughly 7 miles downstream. The confluence can be seen briefly in the following aerial footage, taken on September 19, 2013.

#### Audio 63

As the video pauses, the last section of Medicine Creek can be seen flowing from the left, or west, as highlighted in the light blue, with the Republican River flowing up from the southwest shown in yellow.

#### Audio 64

From the confluence, it's only a few hundred feet downstream to USGS gaging station 06843500 located just east Cambridge on the Republican River. The Republican River at this location flows from west to east.

Audio 65

As the camera pans around to the south, and then around to the east, we see an ice covered Republican River. A close look and you might notice where borings in the ice were made by dedicated DNR staff that made a streamflow measurement on January 8<sup>th</sup>, 2014. The gaging station itself is briefly visible here.

Audio 66

From its headwaters born in the Sandhills to the north to its confluence with the Republican River, this concludes our virtual tour of the Medicine Creek subbasin and of the N-CORPE augmentation project. The real-world conditions of Medicine Creek and operational components of the Project that we have seen here together, provide a good foundation for understanding the actual conditions of this stream.