Sunny Oaks Watershed Presentation Transcript

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Good morning. My name is Danding Gan. I'm the Forest Hydrologist at the Wayne National Forest. Today I will be talking about my analysis for watershed effects from the Sunny Oaks Project.

To start off we will talk about laws and regulations as it pertains to the project. Some are listed here. You've heard them talked about by some of the other colleagues earlier. We will focus first on the four related to watershed and water related resources. The Clean Water Act of 1948. The Bankhead Jones farm tenant act of 1937. Executive orders 11988 and 11990. And forest service manual chapter 2520 watershed protection and management.

Clean Water Act Regulates the discharge pollutants into our nation's surface waters. It was amended in 1972 and 1987. The Bankhead Jones farm tenant act directed the development of a land conservation program to control soil erosion, mitigate floods, and conserve surface and subsurface moisture, among others. Executive order 11988 requires federal agencies to avoid adverse impacts related to the occupancy, modification or development of floodplains whenever there is a practical alternative. Similarly executive order 11990 requires federal agencies to avoid adverse impacts associated with the destruction, modification or new construction in wetlands wherever there's a practical alternative. The forest service's manual chapter 2520 provide policy guidance and management practices that protects , maintains, restore or improves watershed conditions. >> A little bit about scope of this analysis. During scoping some issues were identified . There were concerns about flooding in some of the local areas and communities near the harvest treatments. The concerns stem from that. Clearcutting and Shelterwood harvesting has the potential to increase flood frequency, which could in turn affect homes and businesses located in floodplains. An increase in flood frequency could lead to increased bank erosion which could also threaten infrastructure especially those located immediately next to streams. Some areas where the community has expressed concern are surrounding the community of Aid, near the Elkins Creek Horse camp, skyline road block area, Edwards Road area, and Schaefer school Road area. Some other potential for effects that we also decided to look into was that due to the loss of groundcover from harvesting and road building it may lead to increased sedimentation in waterways. As well as we will be proposing the use of herbicide in some areas am there were concerns that herbicides may contaminate waterways which could harm people if the waterway is used for fishing, swimming, recreation, and especially if it is a public water source.

Before we go further though I want to quickly define what a watershed is. Watershed is an area of land that drains all the streams and rainfall to a common outlet. The outflow of a reservoir, mouth of a bay, or any point along the stream channel. The word watershed is sometimes used interchangeably with drainage basin or catchment . Ridges and hills that separate two watersheds are called drainage divides.

United States geologic survey USGS divided and subdivided the country into six different levels of hydrologic units and they are classified as you can see on the screen. Regions , subregions, basins, subbasins, watersheds, subwatersheds. The sizes are as you can see. At the smaller level watersheds and subwatersheds, it gives you an idea of the size there. the watersheds are like 40,000 to 250,000 acres and subwatersheds are 10,000 to 40,000 acres. For this analysis we had to individually draw smaller watersheds. They will be referred to for the rest of this analysis as localized catchments. These average about 1130 acres but they range from as small as 90 acres to as large as 5000+ acres.

Some of the analysis parameters we will be looking at. First one is water yield. What is water yield? Water yield is precipitation which is rainfall or snowfall minus evapotranspiration. It is the amount of water generated by a watershed. This graphic here gives you an idea of how this all works. When you remove vegetation it decreases evapotranspiration . This results in increased water yield. However, an increase in water yield does not automatically mean that it will result in an increase in flood frequency. There are many factors that play into the flooding phenomenon. Such as underlying soil properties, stream geomorphology, size of the riparian forest, and species of trees within the watershed. They all work together and play a role in the flooding phenomenon.

Another analysis parameter is erosion and sedimentation. What are they? Erosion is when soil is mobilized and moved from where they normally sit by water or wind. Sedimentation is when the eroded soil starts depositing and settling into water bodies. When you remove groundcover vegetation such as tree harvests or farming it accelerates soil erosion when there is a large storm or a high wind event. Sedimentation happens when you have activities that remove groundcover vegetation such as farms, timber harvests, roads, log landings, skid roads, trails, and fire lines, and They have a direct connection to water bodies.

The following picture will give you an idea of what they look like. On the left is a classic example of erosion. On the right as you can see on the bottom of the picture, a smaller stream flowing into a larger River in the middle. That muddiness is caused by sedimentation and erosion.

And another parameter is herbicide used. When we look through the literature in the past we found that water pollution from sprayed herbicides and pesticides usually can be prevented by not spraying vegetation along streams. We have also looked at the same issue as it relates to water quality. Back when we did the Non-native invasive species environmental assessment. That assessment didn't identify any significant effects related to herbicide use. So for this purpose of this presentation we will not be exploring herbicide use any further because we haven't found that they have been having much of an effect.

Look to analyze all of this. We need to provide a boundary for everything, and that's what we call the spatial and temporal boundary . For water yield purposes we are looking at are two different spatial boundaries. One at the Symmes Creek subbasin level and the other at the localized catchment level . For the temporal boundary, looking at research done in the past, basically what the research has concluded is that it takes about nine years for forests in the Appalachians to establish to a point where water yields will return to pre-harvest baseline values once you harvest the trees. That is what we will use. As far as erosion and sedimentation, we are looking at the same localized catchments for the spatial extent. For the temporal extent for different things, we've split it out. For a prescribed burn it is one growing season because once the vegetation starts growing back the effects from a prescribed burn normally is no longer visible or noticeable. For harvest we have split it into short-term and long-term. Short-term is one year because generally vegetation grows back within a year and minimizes the risk of erosion and sedimentation significantly . The long term is nine years, related back to the water yield temporal extent of nine years. Because with increase water yield there is a chance for increased bank erosion . That is where the long-term nine years comes into play.

Following are just some maps to give you an idea of where everything is located. On the left you can see the large hashed area is the Symmes Creek subbasin . The blue line is Symmes Creek itself. At the bottom is where it flows into the Ohio River. The smaller drawn darker areas are the localized catchments. We will be zooming into that shortly. To the right as you can see the Symmes Creek subbasin is divided into three watersheds . Again we are talking about it is divided and subdivided into different sized watersheds earlier. It gives you an idea of what the subbasin looks like and what the watersheds look like.

On this next slide we can see on the left the subwatershed scale . And finally to the right you will see the localized catchments we drew for the purposes of analysis for this project.

Going into methodology and assumptions we will be looking at. For water yield the northern research station for the forest service back in 2012, they came together and looked through previous research done and compile the information and found that about every time when there is 20 to 25% of basal area removed only then will it result in a statistically reliable increase in water yield for that particular watershed or catchment . We also looked at doing quick estimates of that actual yield increase in inches above baseline yield using methodology developed by several other researchers. This was in 1972. Erosion and sedimentation. We are looking at acres of proposed harvest and other disturbances located on soils with severe or very severe erosion hazard ratings. Erosion hazard ratings indicate the likelihood of soil loss after disturbance activities that expose anywhere from 50 to 75% of the soil surface due to logging, grazing, mining and other kinds of disturbance. It is a rating that the natural resource conservation service developed when they did their soil surveys back when they surveyed the entire country. For our methodology and assumptions, we are looking at where these proposed harvests are located , near water bodies where they are 100, 75 or 50 feet from proposed activity. It corresponds back to the forest plan where we have standard and guidelines of 100 foot filterstrips for perennial streams and 75 foot filterstrips for intermittent streams and 50 foot filterstrips for ephemeral streams. We will be looking at how far sedimentation can possibly be transported. They are only physically detectable downstream to another confluence

with a stream or tributary of the same size or larger. Beyond that there is too much variability to be able to accurately track or determined if sedimentation is as a result of management activities upstream.

Early on I talked about water yield and threw out the term basal area. The basal area is the area of a given section of land occupied by the cross-section of tree trunks and stems at 4 1/2 feet above ground. If you look at the diagram here and imagine a birds eye view. Looking straight down from the sky. The big circle is the land area. And the little circles are what the land area that are occupied by the tree trunks. When you look at it that way no matter how many trees you put into the land area it is always going to be less than the actual land area itself. For our purposes for this analysis we are using the actual catchment area instead of the basal area. What happens with that is that because of that, we are overestimating the amount to begin with because you are looking at the land area instead of the basal area. With that I decided we will be using the 25% instead of the range of 20% to 25% as a threshold to determine if statistically reliable water yield increases could be predicted or reasonably expected.

For erosion and sedimentation , some assumptions we will be looking at is that where proposed harvests are located on soils with severe or very severe erosion hazard ratings and also located within 100, 75 or 50 feet from perennial, intermittent, or ephemeral waterbodies. Then they are assumed to contribute to erosion and sedimentation rates beyond what would naturally occur for up to nine years. On the flipside if the harvests are located on soils with slight or moderate erosion hazard ratings, we will assume they will not contribute to increased sedimentation and erosion. The same logic applies to roads, trails, and non-forested private lands. Looking at some of that research done back in 1994, in most cases , you need at least a 50 foot filterstrip to protect water bodies. They also found that 100 foot filterstrips are effective in removing anywhere from 75% to 80% of sediment from storm water runoff.

What is a filter strip? It is the vegetated zone located between a potential pollutant source area and a surface water body that receives runoff. It is often used interchangeablywith buffer strips, riparian management zones or streamside management zones, and other names . The picture gives you an idea of what a filterstrip looks like.

This graphic also gives you an idea that there can be forested type filterstrips or grass filterstrips. On the left here you have the forested filterstrip and on the right we have a grass filterstrip. Both are effective at removing sedimentation and erosion from reaching the streams.

Looking at some of the current conditions within the Symmes Creek subbasin. Some of the water quality earlier this year in 2018, the Ohio EPA released the integrated water quality report. They look at four different assessments. They talk about aquatic life use, recreational use, public drinking water supply, and fish tissue assessment. What each of these does is that they rate and look at the water quality for aquatic life it assesses whether or not the water quality is good enough for sustained aquatic life. Fish, amphibians, other aquatic wildlife that use the waterways. Recreational use is how they rate the water quality for people to recreate in the water. More specifically targets like swimming and other activities where you come into close contact with water. Public water supply assessment looks at whether the water is being

used –if it's safe for use as drinking water supply. Fish tissue assessment looks at the actual fish that they harvest from the streams and whether or not it is safe for consumption.

In most of the subwashesheds within the Symmes Creek subbasin, it is mostly in full or partial attainement for aquatic life use except for Black Fork. Where there is impairment in that fish do not thrive and other aquatic life do not thrive as well. For recreation though it is mostly impaired which means that it is not recommended for people to swim in and the creeks except within the Black Fork and Dirtyface Creek Subwatersheds. The water quality is at a level where it is not as bad for recreation. None of the subwatersheds are being used as water supply for drinking water. They didn't really look for this beyond knowing that fact.

It is mostly unknown in subwatersheds except in the following three subwatersheds, Camp Creek-Symmes Creek, Pigeon Creek-Symmes Creek, and Aarons Creek-Symmes Creek subwatersheds. Where the fish tissue use is in attainment, meaning the fish caught there is for the most part safe for consumption. The overall trajectory is unknown. There was no compilation of official quantitative information before the 2018 integrated water quality report. We don't really have information before then to be able to see if there is a trend whether or not water quality in the subbasin is getting better or worse.

For the localized catchments that we drew specifically for water yield we wanted to look at some of the -- how what is being done in the watersheds may have already affected Water yields. In three of the localized catchments as you see here they have already surpassed the 25% threshold currently. Most of that is actually coming from private land-use. There are some past activities by forest service and private activities that contribute to it but in the three highlighted here you can see the actual forest service activity was from past timber sale and it's included because it is within nine years, but it's on year nine this year which means the effects from it should have -- should be close to returning to baseline levels if not already. A lot of the other private land-use are permanent land conversions such as farms and other activities that are already contributing to increased water yield from baseline where the localized catchments were completely forested.

To give you an idea of where the catchments are located on the map . The Gallia Road catchment and the skyline Road catchment is there. you can see from the aerial imagery a lot of that area is non-forested. Just based on land conversion and land-use. The Tick Ridge Road South localized catchment is similar. It gives you an idea of why it is already over the 25% threshold.

For sedimentation considerations of the localized catchments if you remember earlier they talked about how there is only one subwatershed impaired for aquatic life and that was the Black Fork subwatershed. These localized catchments are the ones that are located in the black fork subwatershed. As you can see here sedimentation isn't a large contribution. Very minimal contribution of the overall impairment. Looking at the water quality report the cause of the impairements are from total ammonia and total dissolved solids , organic enrichment, flow regime modification, and fish passage barriers with a little bit of sedimentation. The main source of impairments are from municipal point sources like Hydro structure impacts like dams and abandoned mine lands. In terms of actual existing sedimentation and erosion issues it is not the main impacts.

To give you an idea of where black fork is located, where the community of Oak Hill is located within the subwatershed. It gives you an idea if you look on the map on the right on the lower section, that is where the two localized catchments are located within the black fork subwatershed.

Back to water yield. We've established that the increase in water yield could result if you remove 25% of the forested areas and in any watershed. That'll lead to a statistically reliable increase in water yield. At the Symmes Creek Subbasin level, it is not likely. They account for only approximately 1% of the Symmes Creek subbasin. However some of the smaller localized catchment areas, the proposed activities, could be of concern. Looking at some of these areas I went out and did some field work and looked around, the streams and riparian areas of these locations have been subject to both historic and recent disturbances and alterations , and many localized catchments are not functioning properly from a natural hydrologic standpoint. The current conditions may not be able to absorb the increased water yield if indeed there is increase in water yield. Therefore an increased risk for higher flood frequency from that. That is why we delved in deeper to take a look.

Specifically there is no known best management practices that helps to address water yields. Design criteria and mitigation measures could be used to help address these issues. Such as spread harvests over time in nine year intervals. The nine years being the time it takes for water yields to return to the baseline levels. We could also possibly conduct stream restoration and enhancement activities to improve flood attenuation. Or reduce the size of treatment areas. What is flood attenuation? During flood events, riparian buffers and wetlands along streams can slow runoff and absorb excess water. What this does is reduce peak flows and can help lessen flooding downstream.

As we talked about earlier three of the localized catchments were already over the 25% threshold. We looked at it. But using that as a current condition that is what's happening. Our proposed action does not add very much to the percent of the localized catchments being no longerharvested. They are short-term. If you look at it from the way the current conditions , we are not going to in this case be adding much more to it. Based on this analysis more or less we can say increase in water yield is unlikely .

At the very beginning we talked about issues from scoping there were concerns about communities near Edwards roads, Schaeffer School road, Elkins Horse Camp area , and the skyline road block area where they are concerned that increased flood frequency could be an issue there. we looked at that closer also. As you can see based on our proposed actions we are also keeping the proposed activities in those areas below the 25% threshold. The concerns here overall isn't as large. Since we are looking at all of this to begin with we started looking at them individually . Notice that in the proposed action in two of these localized catchments, were exceeding the 25% threshold. And in Alternative 2 we decided to try to address for that. With the proposed alternative 2. That would help reduce that down to the 25% threshold.

To give you an idea where the Old Forrest Ridge Road and slab Fork Road South (West) segment is located , this gives you an idea. So these are the two localized catchments where as

proposed has exceeded the percent threshold for water yield considerations. Alternative 2 we reduced it pretty significantly in size to bring it down below the 25% threshold.

For cumulative effects , within the localized catchment analysis boundaries, some things to note is that the current conditions already see regular flooding in many of these areas . Housing developments, farmlands, roads, trails, timber harvests on private lands , they all already contribute to the current water yield levels. Cumulative effects, we will take that as the baseline and combine it with our proposed activities with the foreseeable future activities and that will yield cumulative effects.

Looking at that on a proposed action the only foreseeable we know at this point is within this area is the Buckeye express pipeline that'sproposed. As you can see where we have -- we were worried about localized catchments of Old Forrest Ridge and Slab Fork Road South (West) , the proposed Buckeye express pipeline does not cross through those two localized catchments. So It doesn't really contribute to overall cumulative effects. And the same for Alternative 2 also.

Next we will look at erosion and sedimentation. The locations of concern obviously where the proposed activities on soils with erosion hazard ratings of severe or very severe located 100, 75, or 50 feet from perennial, intermittent, ephemeral water bodies. Standard timber harvest practices are specifically designed to address erosion and sedimentation issues. That is why we will need to make sure we do things properly and make sure we implement the best management practices and focus efforts there. monitoring of these best management practices in the past have showed us in cases where we are only doing prescribed fires, they have very low risk of contributing to erosion and sedimentation on the -- Wayne national Forest. That is for prescribed fires there's very low risk.

Let's take a quick look at the possibilities of erosion and sedimentation contribution from our proposed action and alternative 2. You can see the percentages are actually very low. These are where the land that are close to the streams and other of waterbodies that could potentially contribute to erosion and sedimentation, they are very much in the minority. For cumulative effects again , we have to note that the housing developments and farmlands located in floodplains, timber harvests on both public and private lands, as well as existing roads, trails, and other infrastructure, are already contributing to increased erosion and sedimentation rates within these localized catchments. For Cumulative effects, we're just combining proposed activities with foreseeable future activities to look at that.

Again, the only foreseeable future activities that we know of at this point is the Buckeye express pipeline. Adding that to a proposed action it is still very minimal if you look on the right. The same with alternative 2. The erosion and sedimentation isn't much of a big issue with proper implementation of best management practices would further reduce the concerns in this particular area.

A quick summary of what I went through earlier. In terms of water yield, the proposed action we saw two localized catchments surpassing the 25% threshold of the catchment being proposed for harvest. To account for that in alternative 2 we dialed that back to 18% and 21% ,

so this is below the 25% threshold. For the erosion and sedimentation, the current conditions don't even indicate much of a concern to water quality from this particular source . The potential increases from both the proposed actions and alternative 2 are very little and also very temporary. It is not likely to worsen the current conditions.

With that, I have completed my analysis. Have a good day.