ATV and UTV Trail Guidelines
Wisconsin Department of Natural Resources

V.07/11/2021

TABLE OF CONTENTS

TABLES AND FIGURES

ATV and UTV Trail Guidelines – Wisconsin DNR

Appendix A – Trail detail drawings

- Trail detail 5.0 – Trail cross section (elements)
- Trail detail 6.0 – Trail boardwalk, pier support
- Trail detail 7.0 – Trail boardwalk, pan support
- Trail detail 8.0 – Trail drainage, full bench construction (outsloped tread), contour trail
- Trail detail 9.0 – Trail drainage, crowned tread (flat ground, both sides ditched)
- Trail detail 10.0 – Trail drainage, existing footprint (insloped, ditched uphill)
- Trail detail 11.0 – Vegetative clearing
- Trail detail 12.0 – Typical maintenance

Appendix B – Resources and references

- Wisconsin DNR Wetland General Permit for Recreational Development (https://dnr.wi.gov/topic/Waterways/documents/PermitDocs/GPs/GP4.pdf)
    - Checklist & instructions
- Ford General Permit
- List of resources
- Water ePermitting System Storm Water Permit Application help document (https://dnr.wi.gov/permits/water/documents/ePermittingGuide-ConstructionSite.pdf)
- WisDOT FDM 11-10, Attachment 5.4 – Sight Distance for Crest Vertical Curve (https://wisconsindot.gov/rdwy/fdm/fd-11-10-att.pdf#fd11-10a5.4)
- WisDOT FDM 11-10, Attachment 5.6 – Sight Distance for Sag Vertical Curve (https://wisconsindot.gov/rdwy/fdm/fd-11-10-att.pdf#fd11-10a5.6)

INTRODUCTION

This guidance is intended to provide a consistent statewide framework for the development of ATV and UTV trails with the goal of managing environmental and social impacts, providing a reasonably safe operating environment for riders and machines, and providing quality recreational experiences. Efforts to build sustainable trail systems, that is those that are able to be maintained within the resources available, and do not exceed the capacity of the land on which they are located, should focus on satisfying the broad range of user preferences while applying sound principles of trail design that incorporate physical, social, and ecological capacities. Ideally, a full range of quality riding experiences can be provided throughout the state.

Providing a quality trail experience involves an assessment of current site condition and a thorough consideration of options. Site factors such as topography, existing road or trail corridors, soil types, amount and type of wetlands, water and road crossings, ownership patterns, surrounding land use, restrictive deed language, and zoning can greatly influence the location, safety, and the initial development and long-term maintenance costs of a trail system.

On Wisconsin Department of Natural Resources (DNR or department) lands, ATV trails are open to UTVs with few exceptions; on non DNR lands the decision is made on a case by case basis. Trails open for UTV use need to consider the differences between ATVs and UTVs when planning and managing a trail system. On average, UTVs are wider by at least a foot, twice as heavy, and often carry more than one rider. The additional weight and width of these machines needs to be considered both in determining trail width and surface material.

All ATV (hereafter references to ATV shall include UTV unless otherwise indicated) use on DNR lands will be on facilities designated as open for such use. These facilities may include trails and internal roads. The exceptions are ATV use as a means of personal conveyance as provided under DNR Manual Code 2527.7 for persons with disabilities and for department maintenance and law enforcement purposes.

On department-managed lands, all designated ATV trails will be established following the criteria and process in Chapter NR 64, Wis. Adm. Code and Chapter NR 50, Wis. Adm. Code. This process provides for public review and disclosure of impacts related to ATV trail development and use. The determination for allowed uses on a property, in addition to the five activities automatically allowed on department lands, are determined in accordance with department master planning administrative code (Chapter NR 44, Wis. Adm. Code). These five activities are defined in statute as nature based outdoor activities (NBOAs – hunting, fishing, trapping, hiking, cross-country skiing; s. 23.0916(1)(b), Stats.), The department master planning process determines the land management activities and recreational settings within each property.

DEFINITIONS

ATV: "All-terrain vehicle" means a commercially designed and manufactured motor-driven device that has a weight, without fluids, of 900 pounds or less, has a width of 50 inches or less, is equipped with a seat designed to be straddled by the operator, and travels on 3 or more low-pressure tires or non-pneumatic tires (s. 340.01(2)g, Wis. Stats.).

ATV route: means a highway or sidewalk designated for use by all-terrain vehicle operators by the governmental agency having jurisdiction as authorized under this section (s. 23.33(1)(c), Wis. Stats.).

ATV trail: A marked corridor on public property or on private lands subject to public easement or lease, designated for use by all-terrain vehicle operators by the governmental agency having jurisdiction, but excluding roadways of highways except those roadways that are seasonally not maintained for motor vehicle traffic (s. 23.33(1)(d), Wis. Stats.). ATV trails prohibit the simultaneous use of ATV/UTVs and public motor vehicles, except maintenance and emergency vehicles. Logging operations are permitted provided the trails are properly signed while logging is taking place.

ATV/UTV Troute: *A troute, or hybrid trail, is a classification created for financial purposes only. It is a forest road that allows ATV/UTVs. SS. NR 64.02(9m) and 64.14(2r), Wis. Adm. Code.*

Contour trail: follows the natural topography of the land (contours). Elevation changes are gradual and dependent on the contours of the land the trail traverses.

Forest road: Any road within a forest, managed and maintained by the forest. Forest roads occur in a broad range of conditions. These can include roads that are two way highly developed, with a distinct crown and ditching to very primitive "two – rut" roads that have one lane of traffic and receive minimal maintenance. Forest roads can be managed in an open state or closed off and only re-opened when they are needed for a timber sale.

When is a road not a road?

The department's definition of a road for the purposes of s. 23.116, Wis. Stats., commonly known as the motorized road access law, defines "road" very broadly, and may or may not mean that there is existing public, "street vehicle" access. It generally refers to a "linear feature" that is currently drivable, may be drivable in the future, and was driven on in the past. This is a more broad definition than that for highway, which is the common terminology outside of the department's implementation of s. 23.116, Stats.

Forest road (cont.): When adding ATV/UTV use to an existing forest road, the current condition and expected use levels must be considered. Needed improvements may be as simple as adding appropriate signage or may require considerable improvements based on their current state. In determining what improvements are needed the same criteria used in considering a new trail would be appropriate.

Highway means all public ways and thoroughfares and bridges. It includes the entire width between the boundary lines of every way open to the use of the public as a matter of right for the purposes of vehicular travel. It includes those roads or driveways in the state, county or municipal parks and in state forests which have been opened to the use of the public for the purpose of vehicular travel. s. 340.01(22), Wis. Stats.

Intensive Use Area is a place (park) designed, developed, and managed for use by multiple off-highway motorized vehciles (generally motorcycle, ATV, UTV) that is operated by an entity or entities that perform maintenance and upkeep on a regular basis during the riding season. This area will have tracks and trails that offer varying levels of difficulty and appeal to riders of varying skill levels. Single direction traffic management is often preferred.

Managed use trail use(s) actively managed and appropriate for a trail, based on its design and management. Differs from "designed use" which is the managed use of the trail that requires the most demanding design.

Trail corridor is the trail tread plus the clearing limits on either side of ("cleared width") and above ("cleared height") the tread. This area should be free of brush and obstacles.

Trail tread is the portion of the trail corridor upon which trail use is designed to take place.

Resources

Recommended publications for intensive use area development include the following.

- Fogg, George E. 2002. Park Guidelines for OHVs. National Recreation and Park Association.

Recommended publications for motorized trail development include the following.

- Duford, Dick 2015. Great Trails: Providing Quality OHV Trails and Experiences. National Off-Highway Vehicle Conservation Council.
- Meyer, Kevin G. 2013. Designing Sustainable Off-Highway Vehicle Trails. USDA US Forest Service.
- Wagner, Carmen and Holaday, Steve 2010. Best Management Practices for Water Quality. Wisconsin Department of Natural Resources.

Recommended web applications

- WIDNR Surface Water Data Viewer: www.dnr.wi.gov, keyword "SWDV"

ATV and UTV Trail Guidelines – Wisconsin DNR

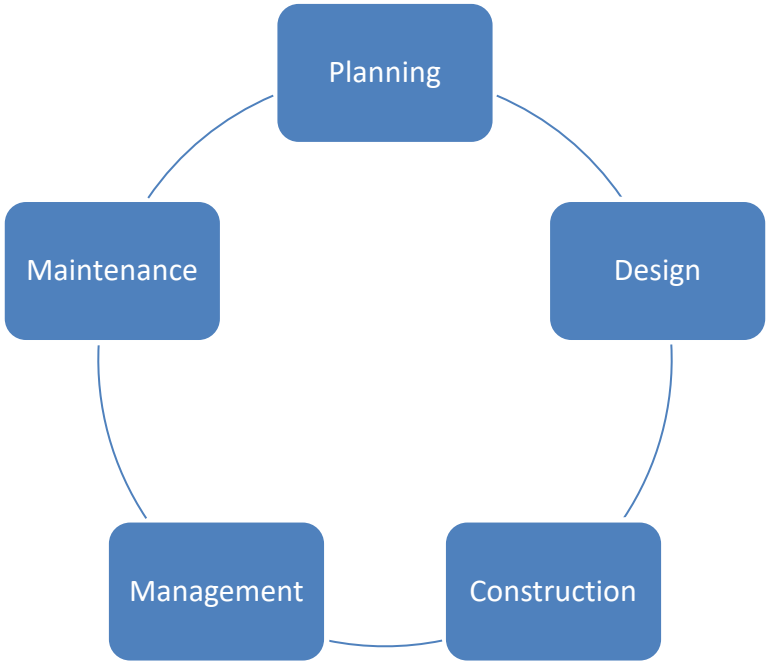
UTV (s. 23.33(1)(ng), Wis. Stats.):"Utility terrain vehicle" means any of the following:

- A commercially designed and manufactured motor driven device that does not meet federal motor vehicle safety standards in effect on July 1, 2012, that is not a golf cart, low-speed vehicle, dune buggy, mini-truck, or tracked vehicle, that is designed to be used primarily off of a highway, and that has, and was originally manufactured with, all of the following:
  - A weight, without fluids, of 3,000 pounds or less.
  - Four or more tires.
  - A steering wheel.
  - A tail light.
  - A brake light.
  - Two headlights.
  - A width of not more than 65 inches as measured laterally between the outermost wheel rim on each side of the vehicle, exclusive of tired, morrors, and accessories that are not essential to the vehicle's basic operation.
  - A system of seat belts, or a similar system, for restraining each occupant of the device in the event of an accident.
  - A system of structural members designed to reduce the likelihood that an occupant would be crushed as the result of a rollover of the device.
- A commercially designed and manufactured motor driven device to which all of the following applies:
  - It does not meet federal motor vehicle safety standards in effect on July 1, 2012; is not a golf cart, low-speed vehicle, dune buggy, mini-truck, or tracked vehicle; is designed to be used primarily off of a highway; and has, and was originally manufactured with, a weight, without fluids, of not more than 3,000 pounds.
  - It has a width of 65 inches or less as measured laterally between the outermost wheel rim on each side of the vehicle, exclusive of tires, mirrors, and accessories that are not essential to the vehicle's basic operation.
  - It is equipped with a seat designed to be straddled by the operator.
  - It travels on 3 or more tires.
  - It is not an all-terrain vehicle, as defined in s. 340.01 (2g).

Why weigh?

The weight specifications for a UTV, and the way that UTV width is measured, have changed in recent years. It is important to recognize that as UTV weights and widths increase, this will impact trail design, maintenance and ultimately trail user experience. Although the power-to-weight ratio is a more important factor than vehicle weight alone, weight can be a significant contributor to the displacement of trail surfacing material. Increased displacement will contribute to an increased need for trail maintenance, most notably grading and adding surface material back to the trail. Without that work, safety and natural resource protection can be compromised. This is particularly the case in areas with highly erodible sandy soils or scattered wetland complexes, and on trails that see a high volume of use.

TRAIL VISIONING



First things first. Think about the following.

- **Planning**
  - What does the master plan say? What sideboards or constraints already exist? What resources are available? Why does this trail need to be built?
- **Design**
  - Who will the users be? What's feasible on the ground?
- **Construction**
  - Who will perform construction? How detailed do construction instructions need to be? How will it be paid for?
- **Management**
  - Who will manage the day-to-day? Who will be eyes and boots on the ground? Who will handle law enforcement?
- **Maintenance**
  - How will the trail be maintained? By whom? With what equipment? How big is that equipment?

TRAIL PLANNING

The first steps in planning a trail are to determine the trail's purpose and objectives (who will use the trail, what need(s) will it meet); concept (where will the trail go (generally)). How it will be managed, maintained, and constructed, and funded in the initial phases and over the life of the trail? Realize that a trail, or trails, can't provide every type of experience that may be desired by users. Take time to consider and determine what kind(s) of trail you are going to provide. This should be dictated by a number of factors, but available resources for construction, maintenance, and management should be key factors.

One user's perspective…

"User preferences need to be a principal concern when managing recreational trails. We must strive to provide the full range of quality experiences that riders want to enjoy.

"Doctrine requires that trail systems be designed with varied opportunities based on user preferences that are broadly part of ATV and UTV riding. Managers must understand and account for user preferences that go beyond the desires of the local land manager or the local club that is affiliated with the trail. The goal is to provide the desired range of riding experiences proximate to where people live. To have a trail system that only offers a single narrow range of riding experiences does not serve riders or the program well. This problem is exacerbated when neighboring trail systems also offer the same narrow range creating what is essentially a large and uniform regional trail system that ignores the desires of a significant number of riders.

"Within the physical, social, ecological, and facility capacities of a trail system, it is important to recognize and pursue the varied preferences of trail users. Ecological concerns can be managed to accommodate the more challenging trail preferences. People buy off-road recreation vehicles to use their off-road capability. Over-developing trails detracts from this experience.

"Providing for the full range of preferred rider experiences should be the first concern. Our efforts to build a sustainable and otherwise sound trail system should be focused on satisfying the broad range of user preferences while applying sound principles of trail design to account for the physical, social, and ecological capacities of the system."

While this represents one user's perspective, there are a variety of persectives that must to be respected and acknowledged. Some riders want wide open trails with little technical challenge; others want a tight, technical, or down and dirty experience – and everything in-between. And the same can be said for just about every trail use. Not every trail can or should try to meet every user's needs, but it's key to plan, as early in the process as possible, the kind of experience your trail will offer.

Not every trail should seek a high level of use. However, recognize the reality that "if you build it, they <may> come". Be upfront with users about the kind of experience your trail

seeks to provide. Riders can and will travel to meet preferences. Consider the bigger context in your region: are other trail types or challenge levels are offered in the area? Is it likely that users will seek the same or different types of experiences? Decide and document these decisions to avoid unmanageable "mission creep" with the purpose of your trail, which can lead to an unmaintainable situation. Seek resources within and outside of the department. A trail, or a certain type of trail, may only be feasible if you partner with other providers or with user groups on maintenance, for example.

The type of trail must be appropriate for the trail's location. All DNR lands are assigned a recreational use setting (ss. NR 44.07(4-7), Wis. Admin. Code). In general, Type 3 and 4 recreational use settings will be most appropriate for ATV trails. Recreational use settings usually vary within a property. Trail classifications (ss. NR 44,04(3)(e-h), Wis. Admin Code) are not dictated by the recreational use setting but may guide the appropriate level and type of trails offered.

Table 1.0 – Trail Classifications

Primitive trail	Minimally developed or undeveloped, narrowest trail type; obstacles likely present in tread
Lightly developed trail	Natural and native (rock, soil or other naturally occurring materials found on or near the trail) surface, tread continuous and discernable but narrow; obstacles may be present in tread
Moderately developed trail	Relatively smooth tread, may include aggregate/crushed stone; wider tread surface
Fully developed trail	Stable, hard tread surface, asphalt, aggregate; widest tread

Table 2.0 – Recreational Use Setting

Type 1	Purpose is to provide a remote, wild area where the recreational user has opportunities to experience solitude, challenge, independence and self–reliance. Substantially isolated from development and be managed to maintain or enhance a perception of remoteness from human activity. Occasional sights and sounds of motors and other human activity may be present but are typically distant, except during hunting seasons.
Type 2	Purpose is to provide a remote or somewhat remote area with little development and a predominantly natural–appearing environment offering opportunities for solitude and primitive, nonmotorized recreation.
Type 3	Purpose is to provide readily accessible areas with modest recreational facilities offering opportunities at different times and places for a variety of dispersed recreational uses and experiences. Landscapes within the setting may vary from natural–appearing to highly altered. Public access and recreational use by motorized means is authorized on roads and trails as provided by the master plan, except within designated non–motorized recreational use areas

Type 4	Purpose is to provide areas offering opportunities for intensive recreational use activities and experiences. Facilities, when present, may provide a relatively high level of user comfort, convenience and environmental protection.

Table 3.0 – Land Management Classifications

Classification title	***Goals***	***Possible recreational use settings (will depend on multiple factors, including the description in the property's master plan)***
Forest production area	Timber production & harvest	Type 1, 2, 3, 4
Habitat management area	Habitat manipulation for the benefit of plants and animals	Type 1, 2, 3, 4
Native community management area	Preserve, protect enhance, restore native communities	Very limited
Special management area	Purposes other than those covered by other classifications	Type 1, 2, 3, 4
Recreation management area	Outdoor recreation & education	Type 2, 3, 4
Scenic resources management area	Natural aesthetics, scenic management	Type 2, 3, 4
Wild resources management area	Natural setting, minimal human impact	Type 1, 2

Planning a quality ATV trail involves an assessment of current site condition and a thorough consideration of options. Site factors such as topography, existing road or rail corridors, soil types, amount and type of wetlands, water and road crossings, ownership patterns, surrounding land use, restrictive covenants, and zoning can greatly influence the location, safety, and the initial development and long-term maintenance costs of an ATV trail system. During the planning process, access and maintenance considerations must be addressed. Trails must be wide enough for required maintenance machinery to travel along the trail for grading and excavation work, for placement of gravel or other surfacing, and for installation of culverts and bridges. Visitor parking and highway access will also need to be addressed at this stage.

New Trails

One of the first elements to consider when planning a new trail is to identify the type of trail use that will be served. A trail running between communities serves as a connector

route, allowing trail users a convenient and fast route to access retail services and other trail riding destinations.
Destination trails usually provide a network of trails within a property, allowing riders to experience a variety of trail riding challenges and sightseeing opportunities. Different trail types are laid out differently to provide challenges based on the rider skills, ranging from casual riders to expert technical riders.


Any land disturbing activity, from installing sign posts by hand to constructing new trail with heavy machinery, requires a call to Diggers Hotline, a free service that will identify underground utility lines. Mark the location where work will take place and then call Digger's Hotline at 811 or 800-242-8511 at least three working days prior to work.
→ **diggershotline.com**

Existing Trails

Over time, regular trail use will shed light on problem areas such as trail rutting, loss of surfacing at corners, or areas that do not drain properly. When planning for existing trail upgrades, a comprehensive approach is recommended to improve the trail user experience. Enhancements to consider include increasing the radius of corners, widening the trail width at corners, and adding gravel or other hardening at the corner. Trail surfacing is often needed to improve ride quality and widen the trail to meet current width standards. Increased volume of trai use can also lead to greater need for a hardened tread surface. Improvements to address drainage problems can include ditching along the edge of the trail and re-grading to enhance water movement away from the trail tread. Many old railroad grades and public property have buried utility lines. Contact Diggers Hotline (811) to have utilities marked prior to any ground disturbing work.

PERMITS

Waterway and Wetland Regulations- Wetlands are nurseries for fish and wildlife, purifiers for lakes, rivers and groundwater, and storage for floodwaters. Local, state, and federal wetland regulations are in place to help protect these important landscape features. The DNR regulates the placement of fill in wetlands such as soil, gravel, construction materials, woodchips or other materials. DNR also regulates many waterway activities to maintain water levels and flows, protect lake and stream habitat, and keep streams free of navigational obstructions. Designing projects to minimize waterway and wetland impacts can not only streamline the regulatory process and reduce environmental impact, but can also reduce maintenance costs associated with trail subsidence and washout.

Many regulated activities, such as installing bridges or culverts or impacting wetlands, have general permits for projects that fit certain criteria. Your best bet is to try to design your project to fit the criteria of these general permits. If you do not, an individual permit may be reqired. General permits are granted for projects that meet pre-speficied design, construction and location requirements. Requirements and fees for individual remits are more extensive. A summary of fees can be found online: https://dnr.wi.gov/topic/waterways/documents/PermitDocs/feesheet.pdf. Permit information is available here: https://dnr.wi.gov/permits/water/.

Repairing existing trails- Did you know that previously permitted trails and support structures can be maintained or replaced without the need for additional wetland or waterway permitting? In-kind replacement or repair of previously permitted infrastructure does not require permitting. Contact your local water management specialist for more information. Information about existing permits can be found in the Surface Water Data Viewer.

Identifying Waterways and Wetlands- The first step to make strategic planning decisions for the trail system is to know where navigable waterways and wetlands are on the property. Wisconsin's surface water data viewer provides reconnaissance level information to begin. On-site investigation is important to confirm navigable waterways and wetland boundaries.

- *Navigable waterways* have defined bed and bank and has waterway flowing on a reoccurring basis at sufficient volume to float a personal watercraft.
- *Wetlands* generally have three components: wet soils, plants that grow in wet conditions, and the seasonal presence of enough water to support those plants.

If you are unsure if a waterway on your property is navigable or a portion of your property is a wetland, contact your local water management specialist for a determination.

HELPFUL HINT: The department's Surface Water Data Viewer is an excellent web-based interactive mapping tool for a variety of data including existing permits, mapped wetlands and wetland inidcators, mapped floodplains, and soil types. The SWDV was updated in May 2018 to provide better information in a more user-friendly format. Check it out!

➔ https://dnr.wi.gov/topic/surfacewater/swdv/

Examples of navigable waterways

Examples of wetlands

Q: When do waterway regulations affect your trail project?
A: Anytime part of the project disturbs the waterway below the ordinary high water mark (OHWM) of a navigable water. Michigan DNR has a video that explains OHWM: https://youtu.be/9li40DGxRNE. Sometimes, above the OHWM is wetland. This can come into play with bridge approaches, which can require a separate permit for wetland disturbance (*see Wetland disturbance section*).

Find out more about waterway protection →https://dnr.wi.gov/topic/waterways/

Find your Water Management Specialist at:
https://dnr.wi.gov/topic/Waterways/contacts.html.
General questions about the waterway and wetland program? Email DNRWMSPublicInquiry@wisconsin.gov.

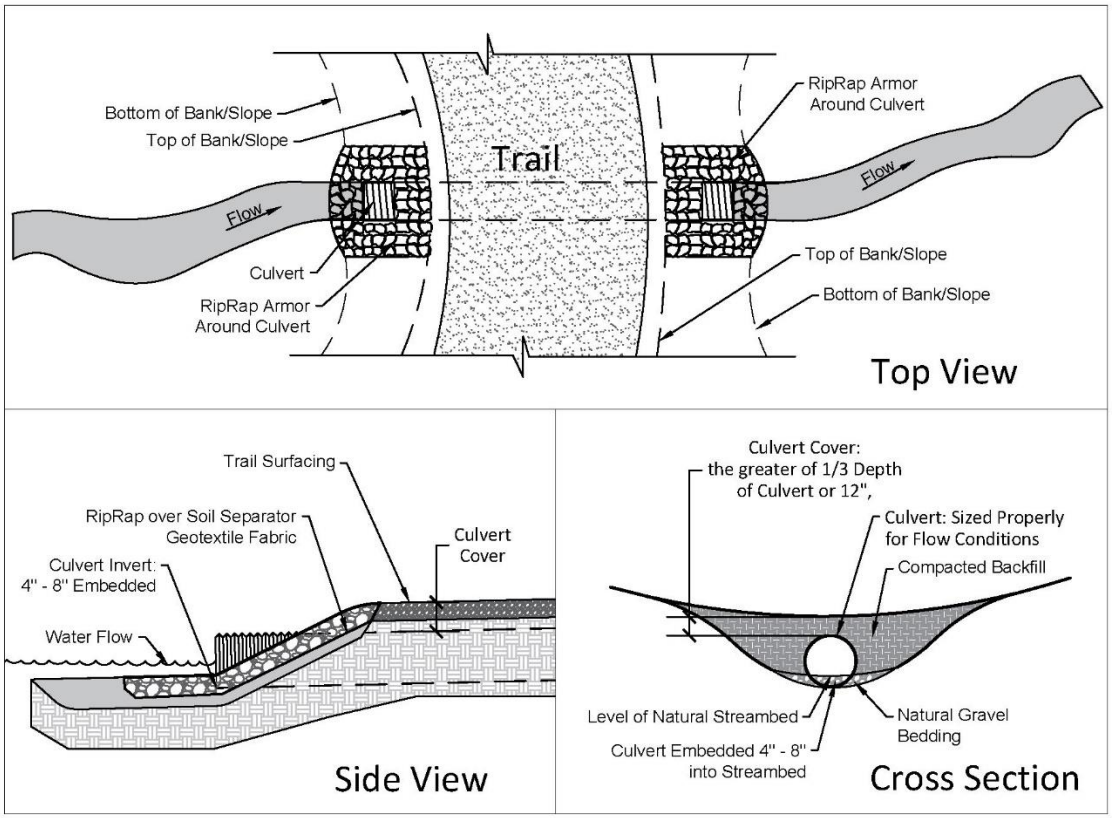
Waterway Crossings

To select an appropriate waterway crossing structure, consider the grade, width, and turns needed to accommodate not only the trail uses but also maintenance equipment. Load rating should be based on anticipated trail maintenance equipment weight for all designated trail uses, as this will be the heaviest anticipated load. It is also important to consider how the structure will intersect with the waterway:

- Look for a straight section with natural narrowing and moderate flows.
- Do not locate a crossing near a sharp bend in the stream or river channel.
- Try to maintain the natural waterflow and path when placing the crossing.
- All bridges and fords should cross at right angles, if at all possible, to the water feature or flow to minimize environmental impact, provide a safe crossing, and reduce costs.

Culverts: Culverts are one of the most popular ways to cross small streams or narrow connections between lakes. In order to minimize the impact a water crossing has on the environment, culverts require the proper size, design and installation to ensure that they don't cause erosion downstream, flood upstream properties, alter stream habitat or block aquatic organism passage. If a culvert is no more than 20 square feet in area and is not located on designated as a public rights feature, a general permit is available. Otherwise an individual permit may be necessary. Visit https://dnr.wi.gov/topic/waterways/water_levels_crossings/culverts.html for more information.

Trail Detail 1.0: Example Culvert Design



HELPFUL HINT: A perched culvert occurs when the elevation of the culvert outlet is higher than natural water level of the stream or channel creating a freefall condition. A perched culvert is an incorrectly installed culvert, and can lead to resource impacts as well as trail maintenance issues. Perched culverts have significant impacts on fish and aquatic life by impeding their movement and migration in streams and waterways. Proper culvert design and placement is *critical* to avoid these adverse impacts.

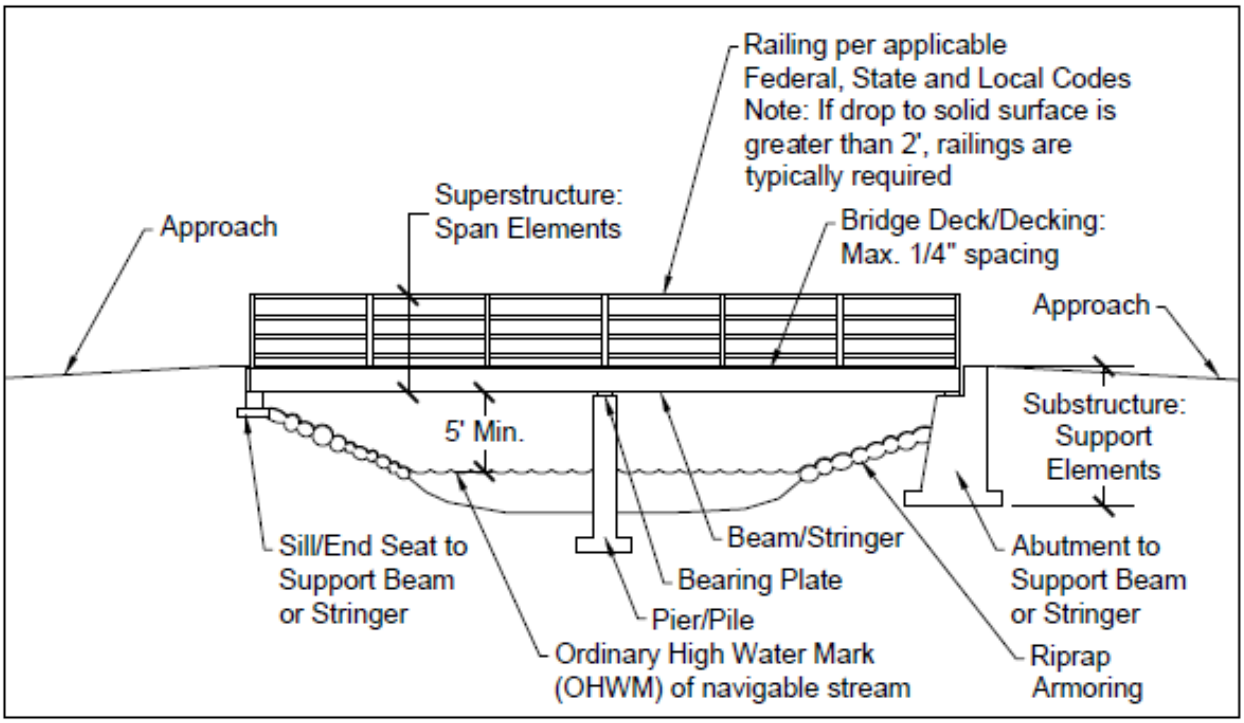
Bridges: Bridges are the most effective and environmentally friendly way to cross water. A waterway general permit is available for bridges that span across a waterway that is less than 35 feet wide, with no support pilings in the waterway below the Ordinary High Water Mark (OHWM). Other larger bridges may require individual waterway permitting. Here are some factors to consider when designing a bridge crossing:

- Bridge clear width for those funded with ATV registration grant funds must be a minimum of 8 feet, 10 feet on railroad grades (NR 64.14 (8)(b), Wis. Admin. Code).
- If possible, choose a site with upland (higher) bank as opposed to a sectional with a wetland edge. This will minimize the impacts to wetland along the stream.
- Navigable waters typically require five feet of boat navigation clearance (top of

water to bottom of bridge) for normal water levels to bottom of the bridge.

- State administrative code allows grant funding for bridges up to 14,000#. Variances are granted for up to 25,000#.
- Bridges on DNR lands are to be inspected in accordance with DNR policy.
- Load ratings (weight limits) should be posted on every bridge in a visible location, on both ends of the bridge.
- **Trail maintenance equipment, including attachments (weight, width, etc) must be considered.**

Trail Detail 2.0: Illustration of Basic Bridge Design Elements

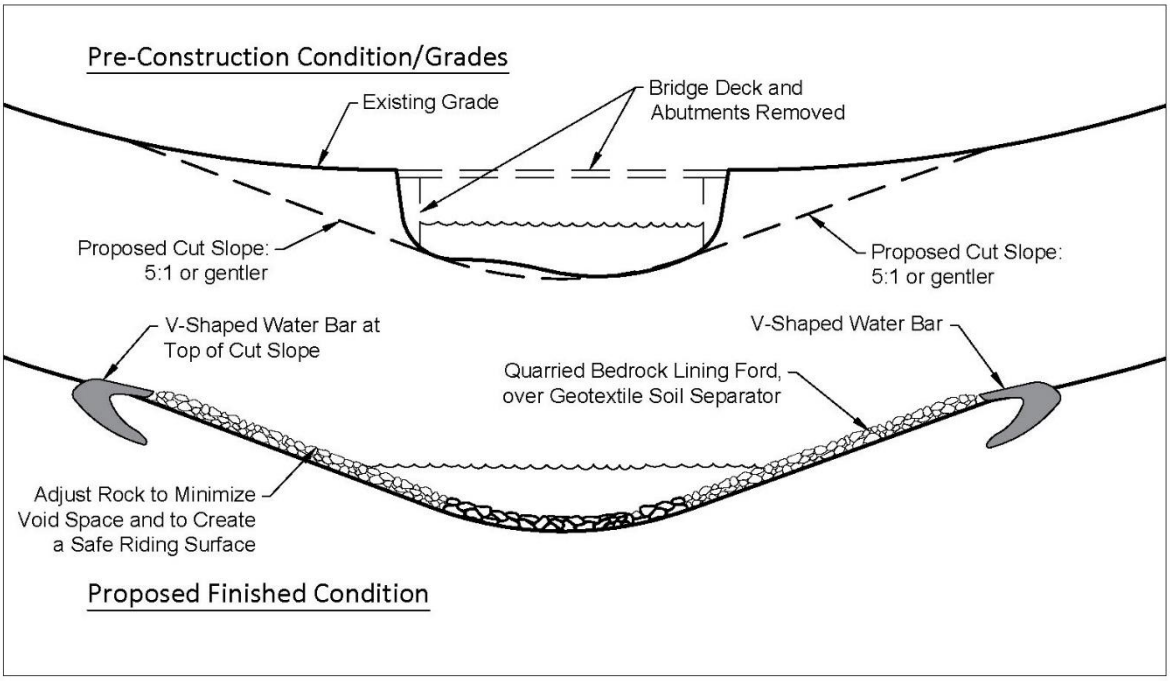


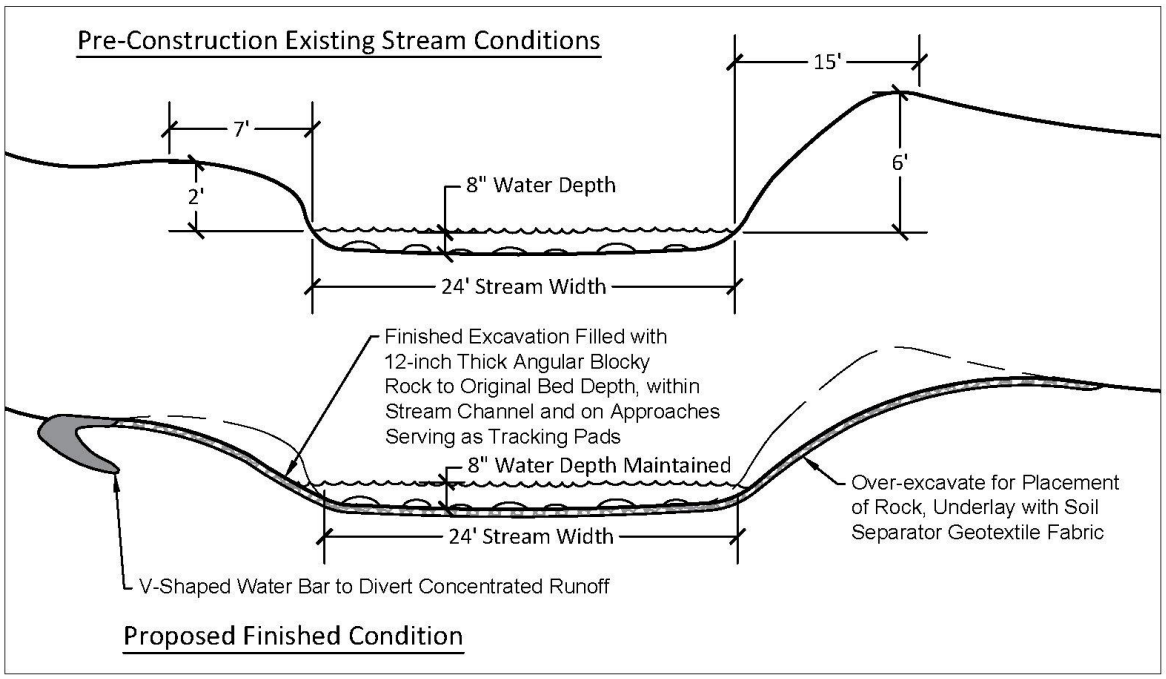
HELPFUL HINT: Start with the narrowest spot. Check out page 67 of the department's *Best Management Practices for Water Quality* for other helpful waterway crossing BMPs: guidance on design, installation, and maintenance of waterway crossings.

Don't forget about the trail leading up to the bridge – grade, width, turns must all be considered and accommodate not only the trail uses but also maintenance equipment – or alternative routes must be identified. Sometimes the areas through which a trail passes leading up to a bridge are low-lying – this can mean they're wetlands and additional permits must be obtained.

Fords: A ford is material, like rocks or timber, that is placed flush with the stream bed to aid vehicles in driving through the water while crossing the stream. It is not appropriate to place fine materials like sand in ford crossings as these materials will quickly transfer into the stream and will destabilize the ford structure. A general waterway permit is typically available for fords that are less than 100 ft. wide and less than 2 ft. deep. For more information visit https://dnr.wi.gov/topic/waterways/water_levels_crossings/fords.html.

Trail Detail 3.0: Ford Design Examples





Project Example: Plum Creek Crossing

French Drain along Toe of Bench

Relocated Bridge

The Plum Creek Crossing project combined several best management techniques to address a range of trail issues, including the relocation of a bridge and use of French drains along the toe of the trail bench to capture storm runoff. French drains are gravel filled trenches, lined with geotextile filter fabric. In this application storm runoff infiltrates into the French drain, flowing along the path of least resistance, reducing sheet flow of water across the trail and deterring trail surface erosion and rutting.

Trails in Wetlands

The placement of material in wetlands is regulated by the U.S. Army Corps of Engineers, the Wisconsin Department of Natural Resources and by local counties, cities and villages. If locating ATV trails in wetlands is not avoidable, DNR recommends installing elevated boardwalks with small footings. These elevated boardwalks are not considered fill material and, therefore, do not require permitting. Placing materials like gravel, bark, or soil directly in a wetland will require permitting. If less than 10,000 square feet of wetland is impacted, a general permit is available- https://dnr.wi.gov/topic/waterways/documents/permitDocs/GPs/GP4.pdf. Larger impacts to wetlands will require individual permitting and mitigation. For more information visit https://dnr.wi.gov/topic/Waterways/construction/wetlands.html.

Artificial wetlands- Newly formed wetlands that were created as a result of human impacts to landscape or hydrology may not be subject to the same permitting requirements as naturally formed wetlands. An example could be an existing but unused (for a long time) logging road through heavier soils where the area within the footprint of the corridor now collects water (hydrology) and plants like woolgrass or reed canary grass take hold (aquatic plants). With hydrology in tight soils, hydric soil indicators also form.

Under the artificial exemption, if the area did not have definitive wetland history prior to 1991 and the wetlands were created as a result of a human modification to the landscape

or hydrology (road building) then the wetlands that formed as a result of the human modification would be exempt from state permitting requirements.

This scenario would need to be submitted through the wetland exemption review process and we would need to gather evidence as to whether wetland history existed in the area prior to 1991, but a strong case can be made that the wetlands formed as a direct result to human modification to the landscape.

If you have a newly formed wetland on your property, contact your local wetland exemption specialist or visit https://dnr.wi.gov/topic/wetlands/permitExemptions.html for more information.

Waterway and wetland permitting

DNR utilizes an e-permitting system for all waterway and wetland general and individual permit requests. Please visit https://dnr.wi.gov/permits/water/ for more information.

Wetlands don't have to always be wet – Many wetlands are seasonal, and may be wet only periodically. Wetlands help absorb floodwaters, absorb excess pollutants before they reach waterways and serve as home and nesting sites to animals. Three-quarters of Wisconsin's wildlife species depend on wetlands and since the late 1800s 50% of Wisconsin's wetlands have disappeared.

Storm water permit

Under ch. NR 216, Wis. Adm. Code, construction sites where a total of one acre or more of land will be disturbed require coverage under a construction site storm water permit from the DNR. For example, if the footprint to create a recreational trail will disturb a 6-foot wide path for a length of 7,260 feet or more, then construction site storm water permit coverage is required since that area equals one acre (43,560 square feet). The permit requires the development and implementation of an erosion and sediment control plan to prevent sediment from discharging to waters of the state during construction until the project is stabilized. In addition, the permit also requires post-construction storm water control to prevent pollutants from discharging to waters of the state after construction is complete. To obtain permit coverage, a complete Water Resources Application for Project Permits (WRAPP, Form 3500-053) must be submitted to the Department a minimum of 14 working days prior to the anticipated start date of construction (permits are good for three years and can be renewed). More information on the permit and how to apply is available from the DNR's construction site storm permits webpage. The DNR has also created program guidance specifically to assist trail developers with design considerations for post-construction

storm water control. Storm water permits should be applied for on the e-permitting system. Please visit https://dnr.wi.gov/permits/water/ for more information.

When is a storm water permit needed?

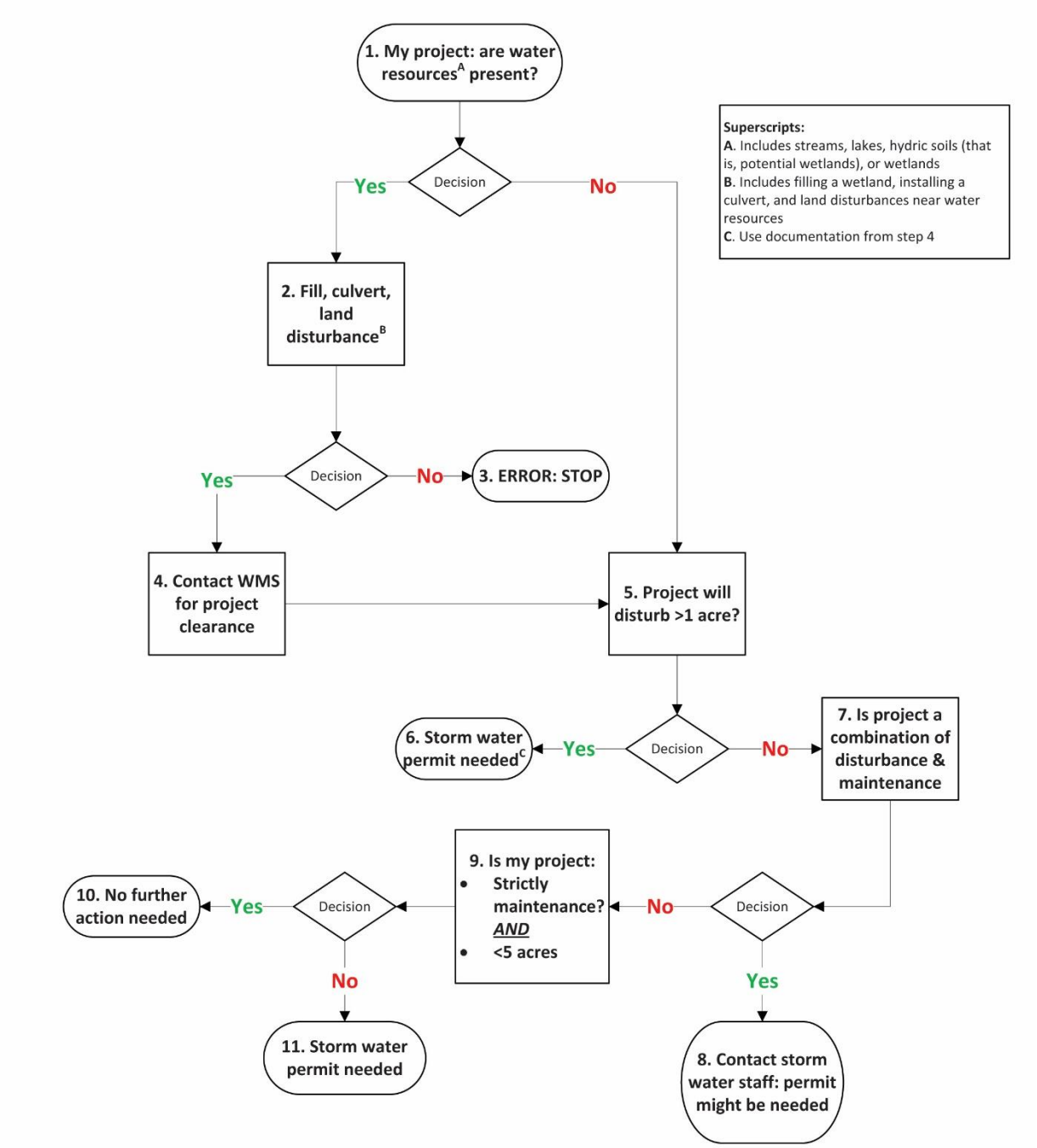
Will your project disturb more than one acre of ground?

If no: Are there any water resources near my project? (Near is 75'. Water resources are wetlands, hydric soils…) If yes, then you need to get a hold of WMS and note this (presence of water resources) in the WRAPP.

If yes: Are wetlands near my project? If yes, then you can do a Delineation or Determination (usually stormwater specialist with WMS or wetland review specialist). Delineation maps the boundaries of the wetland, identifies plant, hydrologic and soil resouces. Determination gives an idea of the wetland and its boundaries of the wetland.

How to comply: Combination of stormwater treatment BMPs (Tx stormwater)
DEFINITIONS:

- Disturbance = clearing, grading, grubbing, filling,
- Maintenance = routine work needed to maintain trail to original specification. (Grade or top dress (with gravel) If a trail gets into major disrepair, and the intended layout or specification cannot be restored, then this work may not qualify as maintance. If less than five acres of maintenance, no permit is required.
- Project = the entirety of the ultimate plan for the trail, regardless of how long it takes or how many phases there are.



Tips for storm water compliance.

- Stabilize as you go.
- Don't disturb ground on any more land than you can stabilize within seven days.
- Use appropriate construction practices.
- Brand new trail: Use slash to your advantage can be used to stabilize work site. Build trail to minimize hydrology changes. Build in erosion control (when constructing adjacent to water resources) to your budget.
- Think about what makes sense: the ultimate goal is to keep the dirt where it is!

Shoreland, Floodplain and Other Local Zoning Ordinance and Regulations

Towns, cities, villages and counties regulate activities through zoning ordinances, All counties, except Milwaukee County, have shoreland zoning ordinances in place that regulate activities within:

- 1,000 feet of the ordinary high water mark of a lake, pond or flowage; or
- 300 feet of the ordinary high water mark of rivers and streams or to the landward side of the floodplain, whichever distance is greater.

Floodplain zoning ordinances and shoreland-wetland zoning ordinances are also typical in many locations and apply in those areas mapped as floodplains or shoreland-wetlands. General zoning ordinances apply to the entire area within a governmental unit.

Counties and local municipalities must follow local zoning requirements for floodplain zoning. Under Wisconsin law (s. 13.85, Wis. Stats.), state agencies are not subject to local zoning ordinances except for floodplain ordinances or when constructing buildings, structures or facilities to be used by state employees instead of for use by the general public. However, the DNR has a policy of trying to comply with local ordinance regulation as much as possible and still achieve the goal of a project. DNR's "good neighbor" policy is to try to comply with the substantive standards that would apply to similar projects completed by a private entity.

DNR staff should not be applying for zoning permits (except when constructing buildings, structures or facilities to be used by state employees instead of for use by the general public), paying fees, or appearing before boards of adjustment/appeals or planning and zoning committees to apply for conditional use permits or variances. Regardless of a whether a project and its design will or will not meet local ordinance requirements, the procedure is outlined as follows. The property manager should advise local zoning officials about the proposed project. Provide zoning officials with detailed information about the proposed project so they can give us their comments and suggestions on how the proposed project might be improved.

For managing entities other than DNR or on non-DNR lands, check in with county and local zoning offices for any regulations specific to the trail project location.

Roadways:

Trails within State Trunk Highway Right-of-Way - Anytime a trail is planned to cross and/or run longitudinally in state trunk highway (STH) right-of-way (ROW), the first step for obtaining a permit is to visit the Wisconsin Department of Transportation's state ROW permits web page. Scroll down about halfway to the "STH connection permits" section (or directly using this link). The fifth bullet item under the "Classifications" section covers trails.

Fill out form DT1504, Application/Permit for Connection to State Trunk Highway, and follow the instructions listed under the website section, "Apply for a STH connection permit" and on the permit form itself. If a DT1504 permit is already in place and you want to do additional work on the trail (for example, changing the trail surface from crushed stone to asphalt), you may only need to fill out form DT1812, Application/Permit To Work on Highway Right-of-Way.

Trails approaching paved roads (public highways) may be required by WisDOT to be paved back 20-30' from the roadway. Trail crossings of gravel roads may also require paving for a short stretch to prevent dips from forming at the trail-road intersections, which can be a safety hazard for both road and trail users.

Snowmobile trails do not typically require these WisDOT permits. Section 350.02 of Wisconsin Statute gives snowmobiles authority to ride within and cross non-Interstate/freeway STH ROW without a permit. Permits are typically obtained when special treatment (e.g., an epoxy coating) is to be used for road and bridge crossings to prevent wear and tear on the highway. Permits are sometimes required for longitudinal trails in STH ROW when a unit of government or club desires to regrade or do other trail work.

- Questions about WisDOT trail permits may be directed to WisDOT staff.

Note that WisDOT ROW varies greatly depending on the highway. On many two lane highways, the average ROW width is 66 feet (33 feet either side of the centerline). The only way to know for sure is to contact the WisDOT region office involved and request a ROW plat.

- Wisconsin Department of Transportation's state ROW permits web page

TRAIL DESIGN

The design of a trail includes the guidelines for the layout, construction, and maintenance of a trail, based on its designed use and other factors.

ATV trails can be categorized into three general types: loop trails, regional trails, and connector trails.

Linear or connector trails are the most common on state properties. These typically fall under the fully to moderately developed trails and are often on old railroad beds or timber extraction routes.

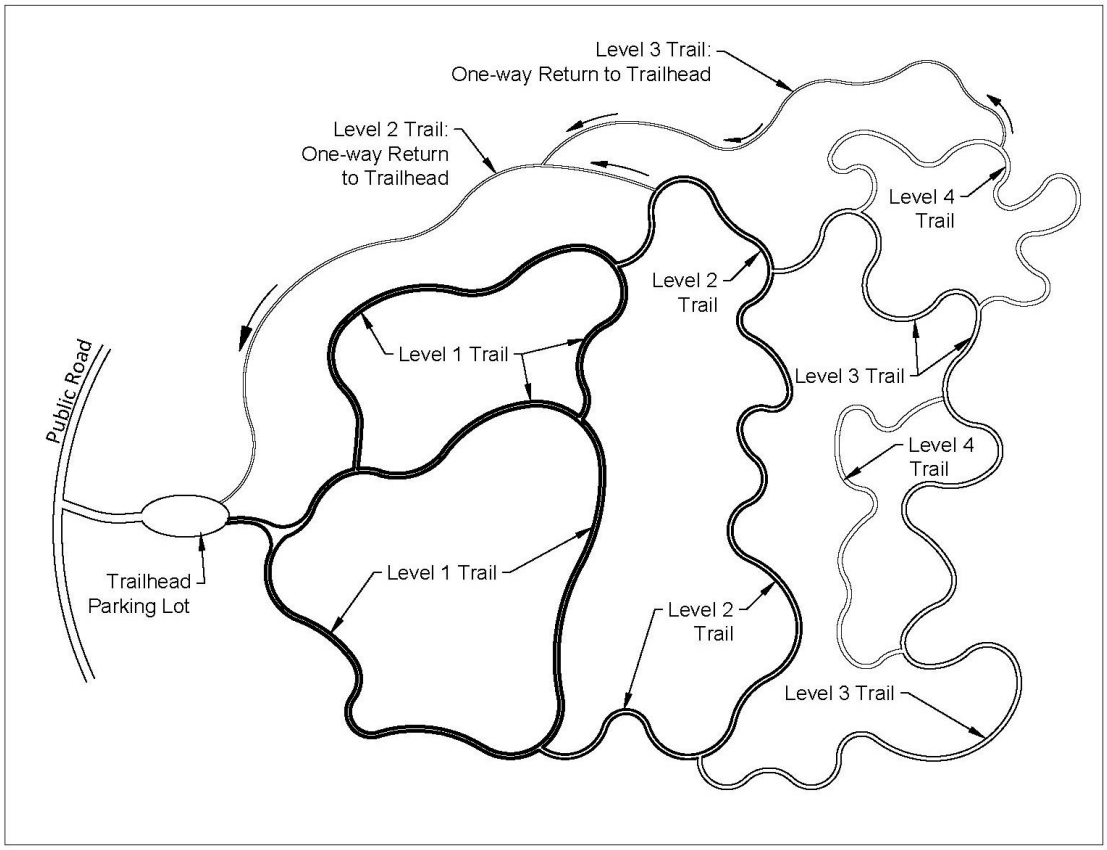
Most linear, state-owned ATV trails are also regional\connector trails. These trails can serve as important connectors between County and Federally owned trails. Most of these occur on state forests and range from fully developed to primitive trails.

Table 4.0 – Trail Challenge Levels / Types

Level 1 trails are intended to be suitable for novice riders and those who don't have the skill or desire to ride more difficult trails. Easiest trails are often used as mainline or "trunk" trails that provide the principal access to a large trail system
Level 2 trails are intended for a majority of the enthusiast population. They require well developed skills and trails that will at times prove challenging to the average rider.
Level 3 trails are intended for a skilled rider. They require above average skills and can tax the skills of an average rider.
Level 4 trails are intended for expert riders and dedicated enthusiasts. At times these trails will tax the skill of the dedicated enthusiast.

Loop ATV trails: Loop ATV trails are typically 8 to 10 miles long but can be any length depending on conditions, challenge level, and experience provided. They can be singular or composed of a series of looped trails (see graphics). These types of trails are designed to provide for a range of recreational riding experiences. A logical design is for the first loop (closest to the trailhead parking area or entrance) for beginner skill level, second loop for moderate skill level, and third loop for advanced riding experience. The layout allows the rider to loop back to the trailhead on a trail he/she judges to be appropriate for his/her skill level. This type of trail system will be designed principally for ATV use and will usually have a trailhead with support facilities, including toilets, drinking water and car trailer parking dedicated to ATV use. In addition, this type of trail can be modified to provide scenic corridors with vistas and/or overlooks and provide activity nodes that include day use, camping, fishing, etc., in addition to a riding recreational experience. Not all loop trails need to be stacked loop systems with increasing/varying challenge levels. Depending on cinditions, a location may only offer one or two different challenge levels. This should be planned for from the beginning of the project. Topography is usually the biggest factor in challenge level.

Figure 1.0: Trail Design Concept – Looped Trail Layouts



There are multiple factors that must be considered during the design process for an ATV trail. As noted above, one of the first questions to address is the trail type because this impacts other design elements. The example in Figure 1.0 shows the hierarchy of trail types from more highly developed (Level 1) to more primitive, technical sections (Level 4). The following table shows the recommended trail types together with the associated design parameters that should be followed.

Table 5.0– ATV Trail Design Matrix

Trail Standards Matrix					
NR 44.07(3) Description	**Primary Surface**	**Design Speed**	**Grades**	**Widths**	**Notes**
Level 1 trails are intended to be suitable for novice riders and those who don't have the skill or desire to ride more difficult trails. Easiest trails are often used as mainline or "trunk" trails that provide the principal access to a large trail system					
Fully Developed Trail	Gravel	45 mph	0-100' <15% >100' <8%	12-16' surface; 5' clear zone each side 6:1 shoulders; Corners – Widen to 18-20'	Railroad grades Connection routes
Level 2 trails are intended for a majority of the enthusiast population. They require well developed skills and trails that will at times prove challenging to the average rider.					
Moderately Developed Trail	Gravel, native soil	35 mph	0-50' <25% >50' <12%	10-14' surface on corners, native soils on tangents; 3' clear zone each side 6:1 shoulders; Corners – Widen to 16-18'	"In – woods" experience; Limited surfacing at corners and problem areas; 1-2 Yr shakeout period to identify problem areas for remediation
Level 3 trails are intended for a skilled rider. They require above average skills and can tax the skills of an average rider.					
Lightly Developed Trail	Gravel, native soil	25 mph	0-25' <25% >25' <12%	8-12' Native soil surface with limited (8' for one way) hardening; 3' clear zone each side 4:1 shoulders; Corners – Widen to 14-16'	Moderate technical challenge experience; Limited hardening to address problem soils; 1-2 Yr shakeout period to identify problem areas for remediation
Level 4 trails are intended for expert riders and dedicated enthusiasts. At times these trails will tax the skill of the dedicated enthusiast.					
Primitive Trail	Native soil	15 mph	0-25' <33% >25' <15%	8-10' Native soil surface (6' for one-way); 2' clear zone each side 4:1 shoulders; Corners – Widen to 10-12'	Technical challenge experience; Very limited hardening to address problem soils; 1-2 Yr shakeout period to identify problem areas for remediation

Table 6.0– UTV Trail Design Matrix

Trail Standards Matrix					
NR 44.07(3) Description	**Primary Surface**	**Design Speed**	**Grades**	**Widths**	**Notes**
Level 1 trails are intended to be suitable for novice riders and those who don't have the skill or desire to ride more difficult trails. Easiest trails are often used as mainline or "trunk" trails that provide the principal access to a large trail system					
Fully Developed Trail	Gravel	45 mph	0-100’ <15% >100’ <8%	16’ surface; 5’ clear zone each side; 6:1 shoulders Corners – Widen to 18-20’	Railroad grades Connection routes
Level 2 trails are intended for a majority of the enthusiast population. They require well developed skills and trails that will at times prove challenging to the average rider.					
Moderately Developed Trail	Gravel, native soil	35 mph	0-50’ <25% >50’ <12%	14’ surface on corners, native soils on tangents; 3’ clear zone each side; 6:1 shoulders Corners – Widen to 16-18’	“In – woods” experience; Limited surfacing at corners and problem areas; 1-2 Yr shakeout period to identify problem areas for remediation
Level 3 trails are intended for a skilled rider. They require above average skills and can tax the skills of an average rider.					
Lightly Developed Trail	Gravel, native soil	25 mph	0-25’ <25% >25’ <12%	12’ Native soil surface with limited hardening; 3’ clear zone each side; 4:1 shoulders Corners – Widen to 14-16’	Moderate technical challenge experience; Limited hardening to address problem soils; 1-2 Yr shakeout period to identify problem areas for remediation
Level 4 trails are intended for expert riders and dedicated enthusiasts. At times these trails will tax the skill of the dedicated enthusiast.					
Primitive Trail	Native soil	15 mph	0-25’ <33% >25’ <15%	8’ Native soil surface; 2’ clear zone each side; 4:1 shoulders Corners – Widen to 10-12’	Technical challenge experience; Very limited hardening to address problem soils; 1-2 Yr shakeout period to identify problem areas for remediation

ATVs and UTVs function in a manner that is similar to cars and trucks that operate on gravel roadways. The laws of physics what apply to a car on a gravel roadway also applies to the UTV operating on a trail.

Design speed is a term used for road engineering that can also be applied to trail design: it is a speed used to determine the various geometric features of the roadway, based on the topography, anticipated operating speed, the adjacent land use, and the functional classification of the highway. Equally, user speed can be controlled by trail design. Design speed is not the speed limit. For more on design speed, this Federal Highways Administration (FHWA) guidance may be helpful: https://www.fhwa.dot.gov/design/standards/151007.cfm.

Horizontal and Vertical Curves

To address the design elements that impact rider safety, trails must be engineered with appropriate horizontal (turn radii) and vertical curves based on the likely operating speeds. For a trail with long straight sections (Type 1), a rider might travel at speeds approaching 45 mph, while a section with multiple curves, hills and dips (Type 4) that requires a highly skilled rider could only be navigated at speeds of 15 mph. Higher operating speeds also mean riders must be able to see longer distances so they can slow or stop for trail features such as an intersection, a highway crossing or a narrow bridge.

The horizontal trail alignment (straight sections and curves) will need to accommodate trail challenge level (Generally, Level 1 trails will be wider and have fewer turns, Level 4 trails will be narrower with more turns.) On all trail levels, corners will need to be designed to accommodate maintenance equipment, volume of trail use, and user skill level. For example, corners on lower level trails may need to be widened to accommodate user skill level (inability to hold a line through a curve.)

Figure 2.0: Sight Distance on a Horizontal Curve

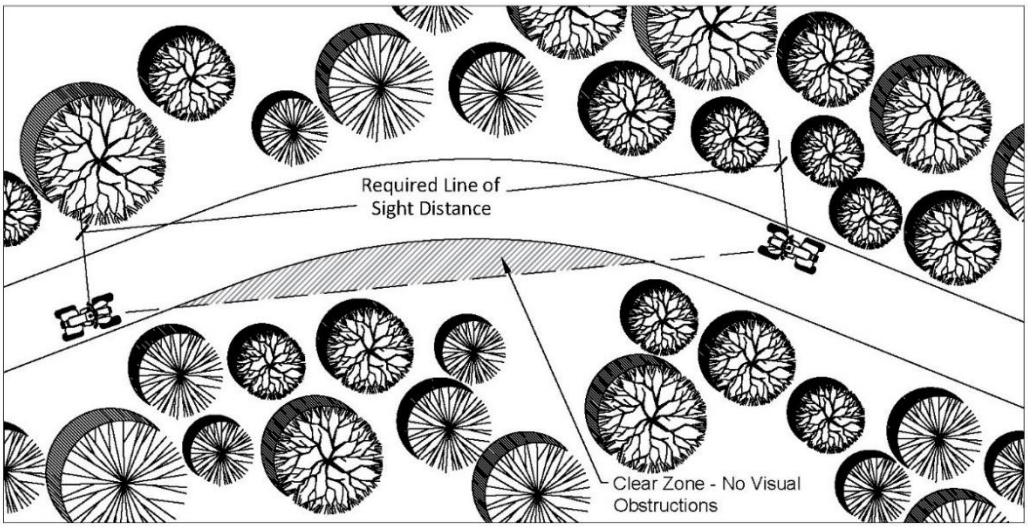


Table 7.0 – Horizontal Curves

Trail Challenge Level	Design Speed	Minimum Curve Radius
Level 1 trails	45 mph	485 feet
Level 2 trails	35 mph	230 feet
Level 3 trails	25 mph	100 feet
Level 4 trails	15 mph	15 feet
Table values based on WisDOT FDM 11-10, Exhibit 5.1 (6% max., 2 lane)		

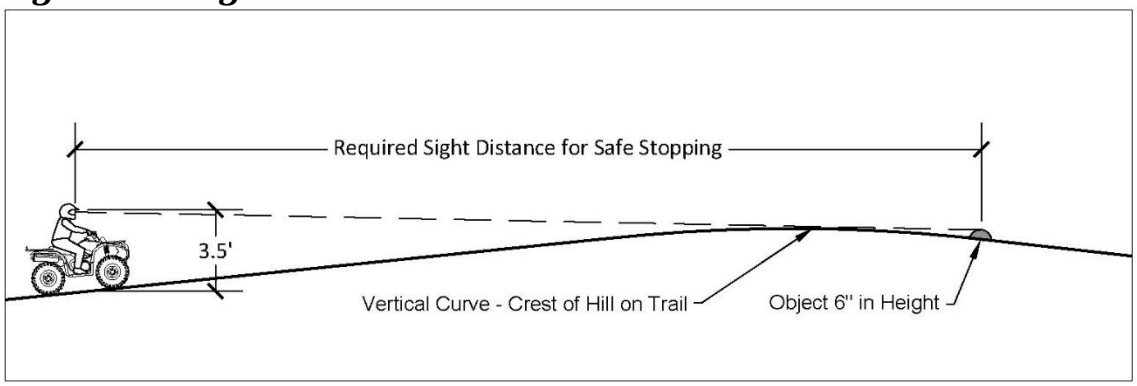
Curve radius recommendations are based on navigating the change in trail direction with a speed reduction of 5 mph. If site conditions limit the curve radius to a smaller curve, appropriate advance signing should be placed before the curve to warn operators af the speed reduction needed to safely negotiate the curve.

Signage for speed reduction at curves shall follow the requirements of the Manual on Uniform Traffic Control Devices (MUTCD), current edition by the Federal Highway Administration, Chapter 2C – Warning Signs and Object Markers.
For hilly areas of the trail, the grade of the trail needs consideration. When the trail crests a hill, the view of the trail is limited by the hill. Rider sight lines need to be taken into consideration. Riders on trails accommodating higher speeds need to see further, allowing the rider to adjust speed if the trail turns or if the rider must stop for a roadway crossing or for an object on the trail such as a fallen tree.

A sag in the trail, when the trail runs down a hill and then turns uphill, has the potential to pose a danger to the rider. During night time operating, the vehicle headlight(s) must illuminate the trail ahead and allow adequate time for the rider to stop or adjust the vehicle speed if an obstruction or dangerous condition lies ahead on the trail. Proper sight lines reduce the risk by allowing time for the rider to recognize potential risks and to either stop or adjust vehicle speed to minimize the risk.

The following figure shows sight lines for the vertical curve on the crest of a hill and a sag condition.

Figure 3.0: Sight Distance on a Vertical Curve



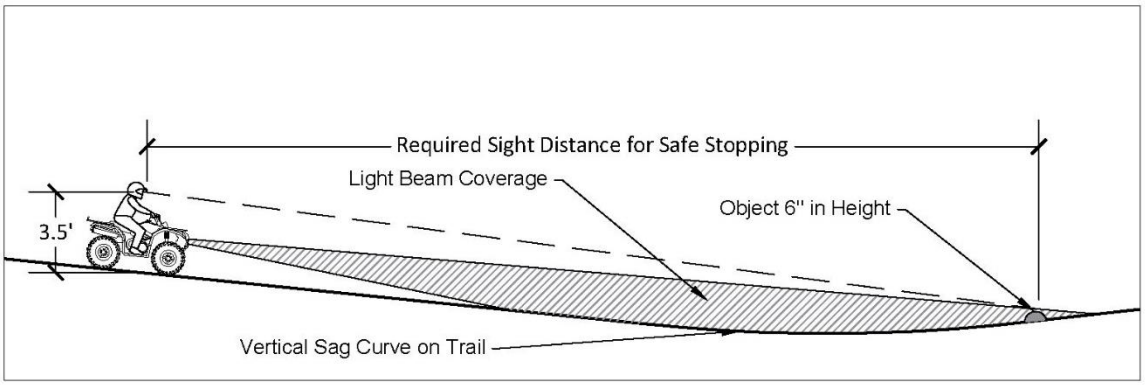


Table 8.0 – Vertical Curves

Trail Challenge Level	Design Speed	Minimum Sight Distance
Level 1 trails	45 mph	360 feet
Level 2 trails	35 mph	250 feet
Level 3 trails	25 mph	155 feet
Level 4 trails	15 mph	70 feet
Table values based on WisDOT FDM 11-10, Attachments 5.4, 5.6		

For additional information on proper sight distances for vertical curves, see Appendix B.

Sight Distance at Corners and Crossings

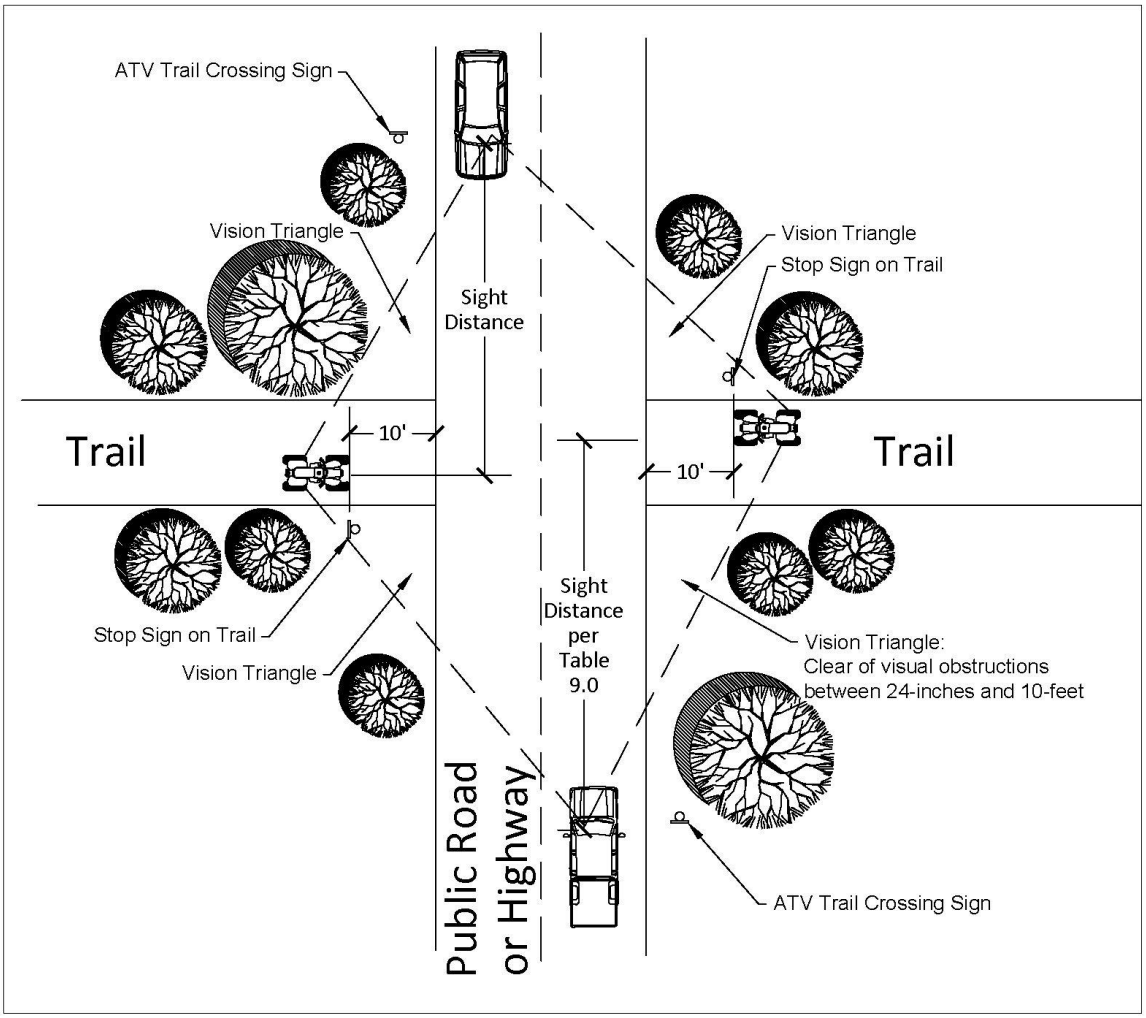
As riders approach a corner, or a road crossing, the view of the trail can be limited by vegetation or other obstructions. Having adequate sight distance allows the rider to adjust speed if the trail turns or if the rider must stop for a roadway crossing. To allow adequate sight distance at corners and road crossings, an appropriate area must be kept clear of vegetation and other obstructions, including large signs.

Table 9.0 – Vision Triangle Sight Distance

Trail Challenge Level	Design Speed	Minimum Sight Distance
Level 1 trails	45 mph	180 feet
Level 2 trails	35 mph	150 feet
Level 3 trails	25 mph	120 feet
Level 4 trails	15 mph	90 feet
Table values based on WisDOT FDM 11-10, Attachment 5.13		

The following figure shows sight lines for the vision triangle.

Figure 4.0: Vision Triangle at Trail and Road Intersections



Typical Sections

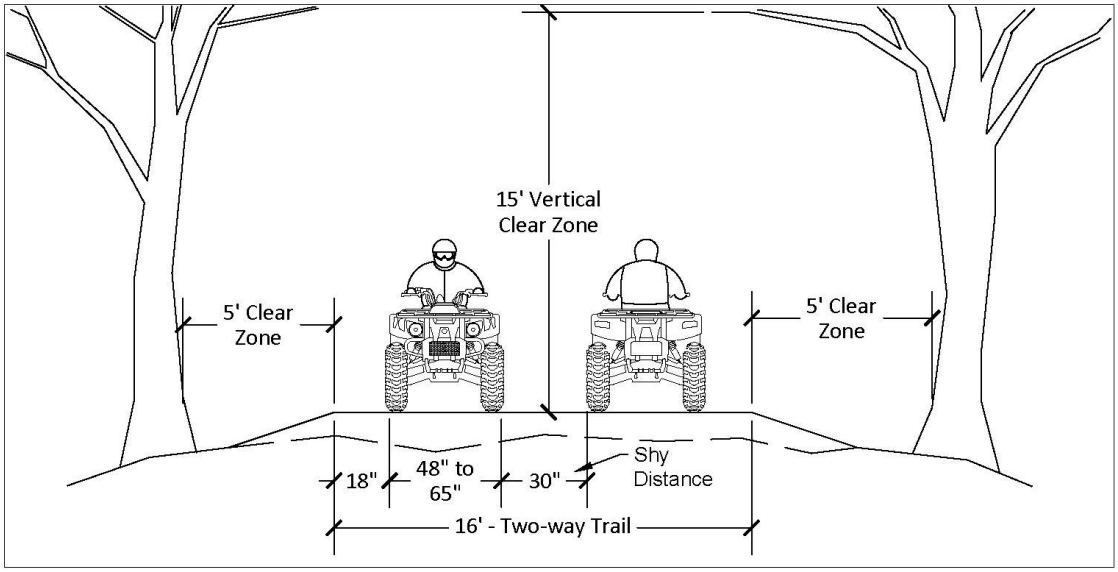
The width of a trail is dependent on the trail type. Higher speed trails need to be wider than lower speed trails and one-way trails can be narrower than two-way trails. Tables 5.0 and 6.0 show the recommended trail width for each type of trail. In

addition to the width of the trail surface, a safe trail is designed with shoulders that allow for recovery if the rider gets off the edge of the trail, and has clear zones (areas clear of trees and obstructions), in case the rider gets off the trail surface. The following shows recommended typical sections for each trail challenge level.

Trail widths should be adequate for intended uses; one-way trails can be built to a 8-foot width. It is recommended two-way trails have a minimum 12-foot-wide maintained trail running surface with a minimum 2 feet cleared on each side. Trails should be wider where turns/corners are required. Adequate width may also be dependent on slope, aspect, and visibility on curves. Please note that in most cases, total trail width must accommodate periodic maintenance equipment such as graders and dump trucks.
The trail width guidelines should be applied when constructing new trails or when an existing trail is upgraded with improvements to the trail surface material or when horizontal or vertical curves are improved to meet sight distance requirements.

The normal straight or slightly curved trail tread for a one-way ATV trail should be a minimum of 8 feet wide for a one-way trail and 12 feet wide for two-way ATV trail. The trail tread will require additional widening of the tread at turns, bridges, water crossings, and intersections.

Figure 5.0 –Typical Section - ATV Trail – Two-way Level 1



TRAIL LAYOUT

An ATV trail has many of the design considerations typical of laying out a light-duty road. The principal difference is that ATV trails are often designed to provide a recreational experience.

The fo1lowing are major items to consider in the layout of potential ATV trails.

Topography

Topographic maps USGS (maps) at 1:24,000 scale are the single most useful tool in laying out and evaluating an ATV trail. The maps provide preliminary information on an overall trail system, water features, elevation change, roads, railroads utility corridors, and cultural features.

Another useful source of information is recent air photos. They can provide information about current vegetation, wetlands, local development, areas to stay away from and features that might be beneficial to the trail. The proposed trail and alternatives should be plotted on these maps.

The soil conditions along a proposed trail are an important indicator of the cost of development and maintenance of a trail.

The ideal ATV trail would be located on upland well-drained soils; coarse, gravely soil would be least expensive to develop for an ATV trail.

The second most desirable soil types are sandy and loamy soils. They may require gravel fill and/or limestone screenings, along with armoring to prevent erosion, especially on heavily used trails and moderate slopes that might exceed 6%.

The least desirable soil types are peat and other wet organic soils that are water saturated at least part of the year. These will always be the most expensive to develop and will require bridging or some types of special construction (see wetland and water crossing section). In Wisconsin, crossing a wetland will require state and sometime federal permits along with special construction to mitigate impacts to the wetland.

Solid ledge rock can be found at or near the surface in some parts of Wisconsin. It can make a desirable trail, provided the area is reasonably smooth -free of fissures or faults. A word of caution: some rock surfaces can become quite slippery when wet. However, with cautionary signing these areas may still be appropriate for ATV trail use.

Almost all soil conditions can be developed into ATV trails with the expenditure of money, but development of these difficult areas will also require long-term maintenance costs. In short, these trail segments with adverse conditions should be kept to a minimum for both long-term cost and environmental reasons.

Drainage and Protection from Soil Displacement

Control of surface water runoff is one of the significant impacts of trail development; it should be the goal of a trail to be hydrologically invisible – to minimize disturbance to natural (or pre-existing) water movement as much as possible. Minimizing the collection or concentration of surface water on the trail tread to the greatest extent possible is key to long-term trail maintainability. The following are techniques that can help minimize water problems by the maintenance of natural surface flow across the trail, the frequent use of drainage dips, and proper use and placement of culverts.

Additive or disturbed surface or sub surface material should be compacted and incorporated into native soil. Depending on soil type, additive surfacing such as 1 ½" fractured rock to a desired depth, incorporated with appropriate amounts of gravel or other suitable material, may be needed to accommodate the long-term viability (maintainability) of the trail.

Slopes

The running slope conditions along an ATV trail are also a good indicator of development costs - and, to some extent, long-term maintenance cost. Slope should be considered in combination with soil type – one soil type may allow for greater slopes with less maintenance than another soil type on the same slope.

A quick way to check slope conditions is to use a 1:24,000 scale topo map for quick evaluation of the slopes along the trail, i.e., 10-foot rise over 100 feet equals 10% slope on a topo map. Flat to mild slopes can be challenging for trail construction as water management features must be built into the trail tread and water management must be a constant consideration in trail construction and maintenance.

Moderate slopes of 6-12% are workable but may require additional construction and maintenance measures depending on soil type. These slopes combined with good trail layout can offer moderate challenge to ATV riders. The maximum sustained grade on ATV trails should be 12% in most situations.

Steep slopes from 13-25% will be problematic for long term maintenance. A steep trail over even a brief distance can provide a high degree of difficulty for ATV riders.

Soils

The soil conditions along a proposed trail are an important indicator of the cost of development and maintenance of a trail. Soils data is available from county soil surveys. County soil survey data can also be researched and viewed within the DNR Surface Water Data Viewer at https://dnrmaps.wi.gov/H5/?Viewer=SWDV. More detailed information on soil types, profiles and suitability ratings can be viewed at: https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Click on the Soil Data Explorer tab, then the Suitabilities and Limitations for Use tab →Recreational Development →Paths and Trails. View these suitability ratings as advisory only – they are not functional judgements from a trail perspective.

Generally in Wisconsin, soils are categorized into sand, silt, loam, clay, muck or peat soils. Soil profile descriptions can be identified by their components, or combination of components. Common usage of soil types across a majority of the state identify soil groups as sand, loamy sand, sandy loam, silt loam, clay, muck or peat. It is important to note that there are a number of individual soil types that are complexes with numerous soil types present. These sites may vary greatly in their characteristics across the site.

Soils fall into four broad categories, Hydrologic Group A, Hydrologic Group B, Hydrologic Group C and Hydrologic Group D soils. The characteristics of each soil affects how the native soil will support a trail, the cost of initial construction, and may be a predictor of the future maintenance needs of the trail.

Hydrologic Group A Soils

Generally, these are well drained and are comprised primarily of sands. These types often have a very shallow organic (topsoil) layer (A-horizon). They also contain limited amounts clay or silt materials. This absence of clay or silt components limits the ability of the soil to "bind" together in a sufficient way to accommodate motorized trails on native soil surfaces. Unmaintained ATV trails on native sand soils can fail under heavy traffic, with rutting, soil displacement during heavy rains, and loss of tread material at corners. Underlying soils are extremely loose and often deep.

Imported soil materials, primarily crushed aggregate, are often necessary on many of these soil types in order to provide safe riding conditions and to minimize erosion and water quality issues.

Recommendations/observations from entities managing trails on Group A soils

- *Trail surfaces often require 6" loose / 4" compacted gravel on a majority of trail systems occurring in this soil type, especially on those soils with shallow "A" horizons and little rock or gravel components in the soil profile*

- *Deep sand pockets and corners may require underlying road fabric or geo-textile. Any fabric applications should be covered with a minimum of 10" rock, crushed aggregate or a combination of materials.*

- *Some trail managers have had better success stabilizing trail surfaces by installing deeper courses of crushed aggregate rather than fractured rock. Larger fractured rock can work its way through the trail surface, causing rough riding conditions. This may be an important consideration when ATV trail surfaces are shared with groomed snowmobile trails.*

Hydrologic Group B Soils

Generally, these are moderately well drained and are comprised of loamy sands and sandy loam soils. These soils often contain significant amount sand, gravel and/or rock but also contain higher amounts of clay and silt. The soil characters within this group provide a better opportunity to utilize native soils as a trail surface.

Hydrologic Group B soils may be associated with topography and slope (end moraines), which presents a higher risk of erosion. Trail construction and maintenance should include designs that call for water to shed away from trail surfaces before it can gain enough velocity to cause erosion.

Recommendations/observations from entities managing trails on Group B soils.

- *Trail projects often allow for at least portions of the trail to lie on native soils.*

- *Pockets of heavier soils, especially on the soils containing more clay and silt, often require crushed aggregate surfaces. In many cases, traffic wear patterns will dictate where these applications are needed.*

- *Particular attention must be paid to slopes on these types. In areas with substantial topography, erosion potential is high and surface water management is an important consideration in order to prevent movement of trail surface and other materials in to adjacent areas.*

- *Soil types with larger rock components may require more aggregate in order to facilitate trail maintenance and grading activities.*

Hydrologic Group C Soils

Generally, these are moderately to poorly drained and are comprised of silt loams, loams and clay soils. These soils contain limited amounts of sand and higher percentages of clays and loams. While a native soil trail surface may support light or periodic traffic, more extensive use often results in rutting and soil compaction.

Rutted and compacted soils within this group often results in water pooling on the trail surface and rapid deterioration of the trail due to ponded water. Unmaintained trail surfaces on these soils often lead to impassable trail conditions and extensive trail tread "creep" into adjacent areas. These soils provide a marginal foundation for trails, and often require more extensive construction methods in order to create a foundation for the trail.

Given the high percentage of finer soil materials present in Group C soils, water infiltration is slow and the poorly drained soils tend to pool water in depressions. Trails need to be crowned to minimize pooling and the ability for water to shed off of the trail surface and into adjacent vegetation is an important component of trail design, including limited ditching with culverts in some locations (where the water cannot sheet off and away from the trail with grading or natural topography, or where it is required for stormwater compliance). Trails should be designed in a way to allow water to flow into areas adjacent to the trail before it has the ability to increase velocity and cause erosion.

Recommendations/observations from entities managing trails on Group C soils.

- *Projects on these soils typically require a minimum of 6" loose/4" compacted crushed aggregate.*
- *Areas of heavier group C soils may require 4" – 6" crushed aggregate over a 6" based of fractured or coarse stone.*
- *It may be more appropriate on certain sites, especially those with long distance slopes to add a larger diameter crushed rock as a base layer and a lighter crushed aggregate cap over the opt. Rock armoring on these slopes is intended for spot applications and not over an entire trail surface.*
- *Wetlands can be present within these types and careful analysis and planning is important to minimize or avoid impacts to wetlands (and waterways).*

Hydrologic Group D Soils

Hydrologic Group D soils are poorly drained and contain significant amounts of clay and organic materials. Wetland/hydric soils, such as muck and peat, fall into this group, adding to the environmental sensitivity of these soils. These soils may provide a poor foundation for trails, and require expensive roadway-like construction methods to build a foundation for the trail. Trails built on these soils often require extensive maintenance and expensive structures.

Hydric types within this group may be regulated by the federal, state, or local government. Trail development on hydric soils should be considered only after all alternatives have been considered and deemed impossible. Cost for trail development, both in terms of initial construction efforts (e.g. permit fees, time,

necessary structures) and long term maintenance costs must be considered.

There are also silt loam soils within this group, some with large amounts of rock, which may present opportunities for trails, and they present similar challenges as Group C. Given the higher probabilities of wetlands within Group D soils, it is often important to consult with wetland professionals before considering trail projects.

Recommendations/observations from entities managing trails on Group D soils

- *Trails traversing hydric soils should be considered as a last resort option*
- *Evaluate trail routing alternatives to avoid trails on hydric soils within this Group D*
- *Trail proposals involving wetlands should be done in consultation with WDNR water regulations staff to determine options and feasibility*
- *For existing trails with wetland impacts already occurring, and less than 10,000 square feet in size, consider a wetland fill permit (WDNR-GP4-2018)*
- *For short wetland crossing distances (generally less than 40 feet) consider a clear span bridge*
- *For longer wetland crossing distances, evaluate the use of puncheon/floating bridges, with considerations for other trail uses (such as snowmobile), which may require structures capable of carrying heavy loads; and long-term maintenance costs*
- *Non-wetland sites in Group D can cause significant frost heave/shrink that will impact culverts and other structures*
- *Some silt loam Group D soils contain significant amounts of large rock, which can result in extremely rugged trail systems when finer soil materials are washed away from the trail surface*
- *Trails can be constructed on non-hydric Group D soils, but there are special challenges involved with maintain water flow off the trail surface and preventing erosion*

It is highly recommended trail sponsors research and understand soil types in project areas. Consult county soil survey data or NRCS web soil data for reference in determining soil suitability for motorized use. When relying on information contained in soil survey data, keep in mind mapped soil types in an individual county or specific area may not always accurately depict actual on the ground conditions. Recreational trail projects require on-site visits and knowledgeable

managers. Most ATV trail systems require soil surfaces that can accommodate vehicular traffic for adequate maintenance, this often means accommodating loaded dump trucks and graders. In some cases, the best alternative for maintenance access will be to perform maintenance activities such as brushing (vegetation clearing) during frozen ground conditions or to create access roads off of the trail tread to accommodate tread maintenance to minimize the need for on-trail access of equipment which may change the nature of the desired trail experience.

Soil type should not be considered in a vacuum; soil type needs to be considered with other factors such as use topography, geographic setting (likelihood to attract high or low volume of traffic over time), weather, and machine weight & power, which will inevitably change over time. Maintenance costs must be considered; any time materials are brought in to a trail, for tread or for structures, maintenance requirements (costs of labor and supplies) increase.

TRAIL CONSTRUCTION

Clearing and Grubbing

The first step in construction of the actual trail will require clearing of vegetation and removal of stumps and roots, loose stones, and other debris from the trail corridor. The area to be cleared should be a minimum appropriate width on straight-a-ways and wider on turns; at intersecting ways, additional clearing may be needed to provide clear visibility in several directions (see table 9.0). Clearing height should always be a minimum of 8 feet, though higher clearing may be necessary to accommodate maintenance equipment. Cleared width will depend on the trail uses and level. See tables 4.0 and 5.0.

Additional clearing but not grading may be needed along trails to remove hazard trees, create aesthetic views, wildlife openings, or restore some native plant community type and manage water runoff.

If the trail construction activity will disturb one or more acres, a DNR storm water permit and other requirements will apply. See information above.

Grading

Grading will be required on new ATV trails. This involves clearing topsoil; usually the darker organic soils are bladed to one side to be used in finish grading of side slopes and shoulders of the trail. The goal is to minimize the movement of soil and create a trail that blends with the topography and create generally smooth arcing trails designed for the average ATV rider.

Trails should be built with a slight crown (on flat ground) or outslope to the downhill side (on contour trail) to allow for adequate and proper water dispersal. Trail surfaces need to be conducive to periodic grading or restoration that promotes water runoff from the trail surface and eliminates the opportunity for water flow to gain velocity, causing material displacement.

On level ground, trails will be crowned from the center to provide drainage.With ATV trails that cross a hill, the trail tread should be pitched toward the downhill side with an outslope to facilitate natural sheet drainage. In some situations, due to storm water considerations, a trail will need to be insloped with ditching to the uphill side to manage runoff. This should only be done when a trail cannot be rerouted to a location (trail layout) that will maintain a grade that will not significantly change the natural hydrography (the way the water acts when it encounters the trail – water should exit the trail as quickly as possible and not be allowed to run down the trail, gaining voume and velocity and increasing soil displacement).

Surfacing

Trail surfaces may be rock or native soils, depending on conditions, but should provide for the ability to grade/reshape/restore the trail surface and cross drainage patterns periodically. Consider grading trail surfaces based on traffic load and surface materials. All trail surfaces should be adequately maintained to ensure longevity and address environmental and safety concerns.

The final top dressing of the trail may be of local soil, which can require frequent maintenance (grading) to maintain trail tread and surface drainage. However, if local soil conditions are unfavorable and trail surfacing must be ordered, crushed gravel or crushed stone in gradation #3 WDOT mix (1 ½"-inch sieve) is recommended for the trail surface. Surface hardening may also be required for short stretches. If more than short section, this treatment may be cost prohibitive and a reroute of the trail location should be investigated. In some circumstances, if a reroute cannot be achieved, trail closure may be considered. Surface hardening may include paving (asphalt, concrete) short sections or use of concrete pavers. All tread hardening techniques can fail over time; many hardening techniques are improperly installed (for example installed too shallow or with improper compacting or amount or size of material (gravel fill) used). Filter cloth is a common material for trail surfacing projects. It can be a successful fix to hold material in place, when properly installed. The use of breaker run is another common way to try and stabilize a trail's surface. Breaker run is large crushed rock (5" (sieve size) 90-100%, 1 ½" 20-50%, #10 0-10%) , used primarily for subgrade correction and improvement. However, the larger size of breaker run can lead to the large fractured rock working its way up to the tread surface, which can then catch on grooming equipment. Smaller breaker run (3" minus) is recommended, but can depend on available rock features such as hardness. Regardless, consider breaker run with less than 5" sieve size for sub-surface material. Successful use on an ATV trail requires compaction and that sufficient material be placed on top of the breaker run to, over time, allow for top dressing to filter down to fill in gaps between the breaker run while still covering the top of the breaker run. Otherwise, by its nature, the large, fractured breaker run will work its way up to the trail surface (or the top dressing will work its way down into the breaker run), and stick out of the trail surface. This can cause issues for trail users, and also for trail maintenance (e.g. some trail graders have tines that will get stuck on the protruding breaker run).

Look for successful surface hardening projects in similar conditions. If not available, try piloting sections before invesing heavily.

Be sure to take into account other uses of the trail. For example, if bicycles will also use the trail, it is unlikely most bicycles will be able to use a trail with stone greater than 1". This must be balanced with the tendency for some rock

(particularly limestone) to break up under heavy motorized use. I.E. rock too small and too soft turns to dust under ATV tires; rock too big and too hard means difficult pedaling and flat bicycle tires. ATV "trails" placed on active (or those that may be active in the future) logging roads usually require additional surfacing and maintenance considerations. A full logging truck can weight 80,000#, four times that of a 20,000# ATV grooming rig. Close communication with the forester and contractor is required to ensure that logging and ATV use successfully coexist during and after a timber harvest.

TRAIL MANAGEMENT, MAINTENANCE & MONITORING

Trail Inspections

Biannual designated use area inspections are required to be completed for facilities on DNR lands, pursuant to section 23.115(2), Wis. Stats., further described in Manual Code 2527.20. Environmental inspections and monitoring of trail conditions should be recorded at that time, as well. For Bureau of Parks and Recreation Management properties, all completed inspection forms should be uploaded to the district designated use inspections SharePoint folder.

Trail Surface & Drainage Structure Maintenance and Rehabilitation

Motorized trail maintenance is as important as trail planning and design. An effective monitoring program is key to a successful trail. Trail maintenance is intended to restore the surface and tread area to the original or modified design setting to sustain the corridor for the enjoyment of the trail users. Failure to conduct proper trail maintenance results in erosion of the trail surface, collection pools of water, and trail width 'creep' as users try to avoid undesirable consequences from unmaintained or poorly maintained trail sections. Ignoring problem sections of motorized trails ultimately results in significant reconstruction costs that could be avoided with proper maintenance.

Trail maintenance is more than just grading or back blading the trail surface to smooth out the tread area. In fact, some improper trail maintenance exasperates the problems caused by overland flow of water from precipitation events. Every effort should be made to maintain the trail tread above the immediately surrounding ground surface to facilitate quick removal of water from the trail. As noted earlier, water volume and velocity are trail maintenance worst nightmare. The sooner water is removed from the trail area, the less chance water has to displace top dressing and subsurface layers causing gully erosion of the trail and unwanted deposit of valuable trail material into woods, wetlands or surface water.

Proper trail grading techniques should emphasize keeping the trail tread above the surrounding ground surface by maintaining and restoring the trail crown, eliminating side berms and recovering displaced trail material caused by trail use or past improper grading activity. In some cases, this may require using bladed equipment with the ability to adjust the angle and camber of the blade to simultaneously recover side berms and restore trail crown. Some trail surfaces are pitched, rather than crowned, as they follow the ground contour. The trail pitch provides riding variety for the user and facilitates overland flow of precipitation/spring run-off to cross the trail without collecting on the trail surface.

Knowing and communicating where trail construction contains water conveyance devices is critical. The most common; cross drain culverts are familiar to most. Less

obvious to maintenance folks are such structures as; diversion ditches, broad-based dips or French drains. Failure to inform trail maintenance staff of the location of these key features can result in grading activity rendering these water conveyance structures useless and cost additional resources to re-establish effectiveness.

The key in proper trail maintenance is effective communication and coordination of efforts. Spending time and field visit trail sections with maintenance staff to identify proper grading techniques to restore and maintain the original trail grade and identify water conveyance structures, and the purpose of such structures, will minimize the potential for future trail failure.

ATV trails should be regularly inspected (at least every few weeks) for tread and drainage conditions; more frequently at the outset when determining proper maintenance schedule. Work out a regular maintenance schedule and stick to it. Regular maintenance can help prevent costly maintenance and repairs later. Trail grooming may need to take place as often as biweekly to maintain trail surface and drainage. Investment at the outset (a well-designed and constructed trail) takes less maintenance work in the long run.

The use of rock for armoring ATV trails is becoming more popular as the weight, width and number of machines using public trails continues to increase. This is readily apparent on trails shared by UTVs which are much heavier than a standard ATV.

Selection of the type and depth of rock is often dependent upon soil type, topography, amount of use, type of machines, and the layout of the trail. Trails with sharp corners and curves often require additional material to facilitate grading and maintenance on these sections. The use of rock for armoring reduces the long-term maintenance costs on trails and can prevent the closure of trails during weather related events and result in an economically and environmentally sustainable trail.

Sizing of material should be limited to rock that has a gradation of less than 2 inches whenever possible. Use of larger rock such as breaker run, rip rap or pit run material creates long term maintenance problems, especially on multi use trails shared with snowmobiles. Where breaker run or larger material is used, it is imperative to place enough material of 2 inch gradation or less as cover to prevent contamination of the upper layers of the trail. If this is not done properly, the larger material will mix with the smaller material due to frost action, grading and heavy use by ORV's. When this occurs, the trail is often impossible to groom with tow behind grading equipment, can damage snowmobiles and create dangerous situations for winter grooming equipment. The larger rock often freezes to the trail and is thrown towards the pulling units when the spring-loaded blades of the groomer break large pieces of rock free from the trail surface. This is especially evident on corners where the turning action of larger machines cause contamination and the placement of larger material should be limited to "straight" sections of trail. This may require realignment of the trail tread but will save on long term

maintenance costs. Hydric, clay or loamy soils may require the increase in the thickness of material placed but will create a uniform profile that can be graded without the possibility that contamination occurs. Jackson County, which hosts one of the busiest trail systems in the Midwest, has experimented with the use of 1 ¼ inch material of varying thickness in several different soil types and had good success in providing the surfacing necessary to safely pass the heaviest of UTVs and grooming equipment.
Selection of material is important to the success of the surfacing project. The binding material of different types of material is important in the compaction of the final trail surface and is more resistant to movement by off road tires. For this reason, WisDOT specifications should be required when bidding material.

See USFS reference on using concrete pavers – also get info from CNNF feds about their experience with triloc blocks.

❖ *Trail Maintenance – One County's Story*

Note: This is an example of the typical required maintenance for a trail on a railroad grade.

The initial trail development on our cooperative State Trail was done in the late 1980s through the mid-1990s. By about 2008, the Trail was in need of a major trail surfacing project. Limestone screenings here have about a 10-year life cycle. In open, above grade terrain, the original 1998 trail surface is still in good condition. In areas where the trail passes through cuts and heavily wooded areas, the trail deteriorates more rapidly. County staff wrote and submitted a Stewardship grant application in 2017 for work on 6.8 miles of trail regrading and resurfacing that mostly targets those areas more susceptible to weed growth and surface deterioration. The application included 1.5 miles of side-ditch cleaning (both sides of the trail) and 0.2 miles of new stone base raising the trail surface about 6 inches on a section of trail, that side-ditch cleaning alone was inadequate for keeping the trail surface dry and firm.

By early 2018, the DNR made a grant award and the county signed grant contracts. County staff updated bid specifications originally written by DNR staff in the 1980s and the county advertised for sealed bids with an opening in late May. Bid specifications included a 45-day completion time and bids came in at twice the anticipated cost per mile. Our County Highway Department, a reliable bidder in the past did not submit a bid due to a full construction calendar. Phone calls to prospective bidders determined that area contractors were booked for much of the year, accounting for the high bids. Revisions to the bid document with a November 16 completion date resulted in new bids within budget. By October- November in Wisconsin, the asphalt-paving season is over that frees up contractors to take on jobs like recreation trail resurfacing.

Pre-Construction Work Sequence

Our pre-construction sequence is as follows.

1. Public notification. Our County uses posts on the county homepage and on the county parks and trails, Facebook page to make trail users aware of the upcoming trail work. We have a local user group with a Facebook page and we post on their page as well. We follow up the initial notification of work with periodic updates including photographs of the work in progress. A number of individuals and groups share or repost the county's posts.
2. Diggers Hotline. Always. We have an AT&T fiber optics line buried adjacent to the trail near the ditch line. We have never had an incident and we plan to keep it that way.
3. Drive the trail with the contractor. This can be time consuming on the front end, but it saves time and surprises during construction. There are always questions regardless of how thorough you think you wrote your bid specifications. Talk about timing, start-stop points, safety, keeping the trail open to users as much as possible during construction, leaving the work site each day with the trail usable, etc.

Construction Work Sequence

This sequencing is largely up to the contractor. Our contractors typically follow a similar work sequence.

1. Scraping organic matter from the 12-foot trail bed and reshaping the base to shed water to the sides. Loading and trucking the waste material to a local fill site. Compacting the freshly graded base with a vibratory roller. On this project, the contractor used a small road grader doing a pass on each side of the trail and pulling waste material into a windrow down the center of the trail. When complete, the graded surface is approximately 12 feet wide.
2. Using a small rubber tired loader with a push blade, scoop windrow waste and load into a tri-axle truck for hauling to an off-trail fill site.
3. Using a vibra-compactor, roll the graded base that is now a combination of railroad ballast and old limestone screenings.
4. Using a small rubber tired loader, scoop debris from side ditches and load into a tri-axle truck for hauling to an off-trail fill site.
5. Using a string guided asphalt-paving machine, lay a 10-foot by 3-inch compacted course of damp, crushed limestone screenings. Leave a 1-foot shoulder of base material on each side of the trail surface. Roll the edges of the surface material to bevel the edges. The rolled edge provides a reasonable transition should someone ride off the edge of the trail. Make sure your contractor picks up the string guide when done.
6. Post construction inspection. We all do this from in a vehicle. I add to the inspection by riding on my own down the trail and back. I do this alone

because I cannot ride, carry on a conversation and look for construction issues all at the same time. Getting outside the shell of a truck seems to work better for me, and riding the finished project gives me the same feel as our trail customers.

Equipment Used

1. John Deere 70 Grader
2. Volvo 180 Excavator, rubber tired
3. Kubota U55 Excavator w/edge bucket
4. New Holland 227 Skid Loader w/tracks
5. JCV Compactor, smooth drum roller
6. 2-drum smooth mini roller

1. Trail after vegetation clearing work, but before surface improvements

2. A small road grader was used to remove organic material from trail edges

3. Equipment used to clean up and remove windrowed organic material: skid steer (bucket shown in the lower right), a small rubber tired backhoe, and a tri-axle dump truck.

4. After re-surfacing with a 6-inches compacted course of 3-inch minus stone laid on the regraded trail. The original trail screenings below were still white and clean.

Final Thoughts

I learned three things on this project. One, advertise for bids in early January, when contractors are looking for work. Two, do not hold back on side ditch cleaning. In an effort to cut costs on the project, I omitted ditch-cleaning work on a 0.2-mile section of trail surfacing. After seeing the regraded base on this section of trail without ditch cleaning, it became obvious the graded surface was holding too much water. We issued a change order and the contractor cleaned the ditches on a T & M basis before laying the final trail surface. Three, safety issues. Although the bid package included a paragraph on safety, the paragraph was not adequate. A pre-construction meeting is needed to stress the importance of safety on an open public trail.

Trail Vegetation Maintenance

All ATV trails will require at least yearly vegetation maintenance. The work is best accomplished in the dormant seasons of late fall or winter, but may require some summer time maintenance due to heavy vegetation growth. Vegetation should be cleared to twelve feet over the trail and two feet on either side of the trail. Particular attention should be paid to hazard trees and limbs along the trail. Overhead and side limbs clearing should take into account the wet and ice-covered limb vegetation that may block the trail. See vegetative clearing detail.

Aesthetic qualities should be taken into consideration – refer to draft guidance Wisconsin Forest Management Guidelines -chapter 4: https://dnr.wi.gov/news/input/documents/guidance/2018ForestManagementGuidelinesDraft.pdf.

Monitoring

A monitoring plan, formal or informal, is crucial to ensuring that the investment made in a trail doesn't go to waste. A monitoring plan should be determined during the planning phase: benchmarking during construction should take place, and a formal system to observe, record and report conditions at regular intervals in the life of the trail should be developed and documented. For more on monitoring plans, check out pages 28-29 and 179 of NOHVCC's *Great Trails: Poviding Quality OHV Trails and Experiences* (see the Resources section on page 6 of this document).