

MN DNR's New Trail Planning, Design, and Development Guidelines

Recreational Value and Sustainability through
Sound Planning and Design Practices



Introduction

- Presenter: Jeff Schoenbauer, Brauer & Associates, Ltd.
Principle Author and project manager

- Provide a snapshot of new *MN DNR's Trail Manual*
 - Importance of quality
 - Importance of sustainability

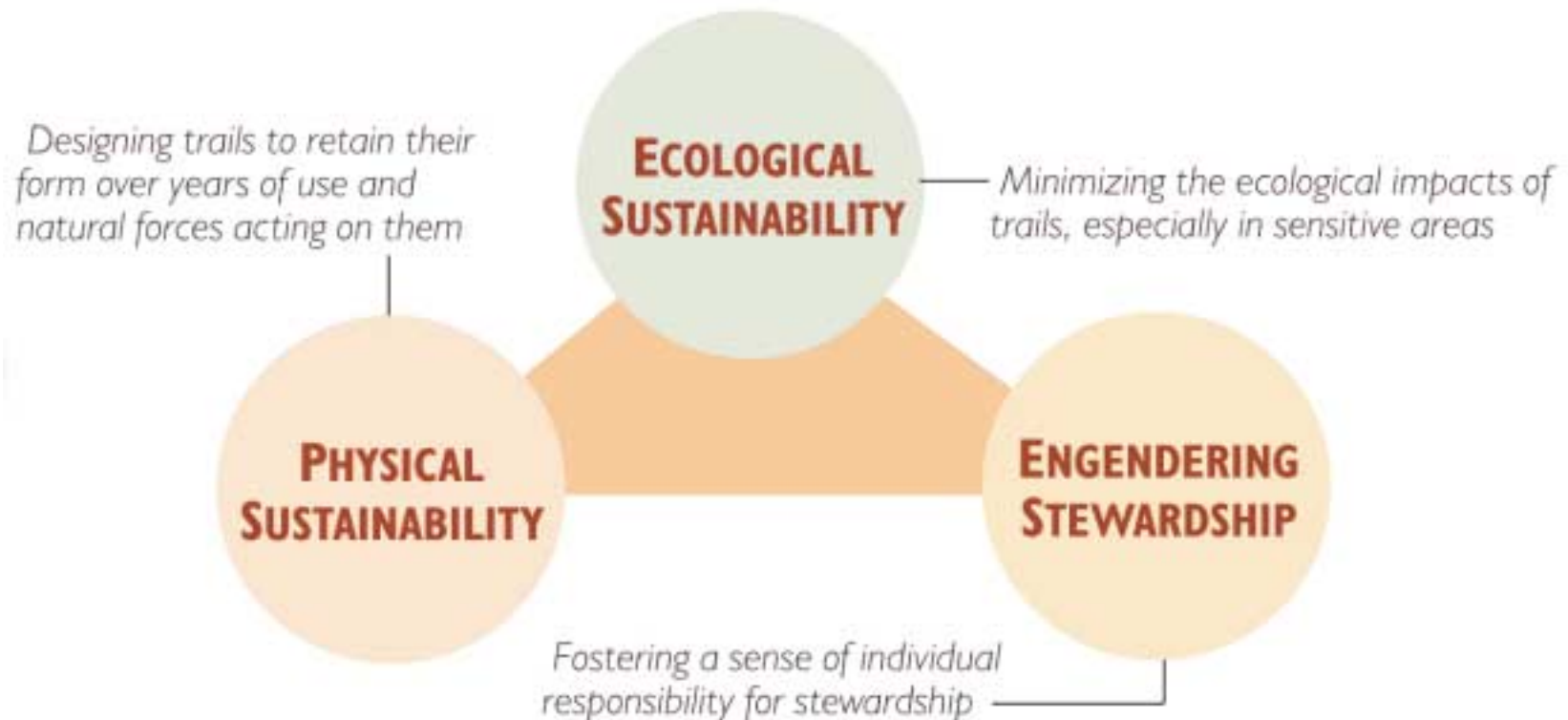
- **Status: *Publication is now available!***

Overview of Trails Manual Goals

- Provide a consistent set of guidelines and common language for trails
- Fill gaps in best practices and techniques
- Emphasize proper trail planning and design as a means to ensure sustainability
- **Seven sections** –
 1. Planning,
 2. Design Principles
 3. Ecological Sustainability
 4. Trail Classifications
 5. Shared Use Paved Trails
 6. Sustainable Natural Trail
 7. Winter-Use Trails

Key Factors in Developing Sustainable Trails

Three key factors in trail sustainability:



Underpinnings of Sustainability

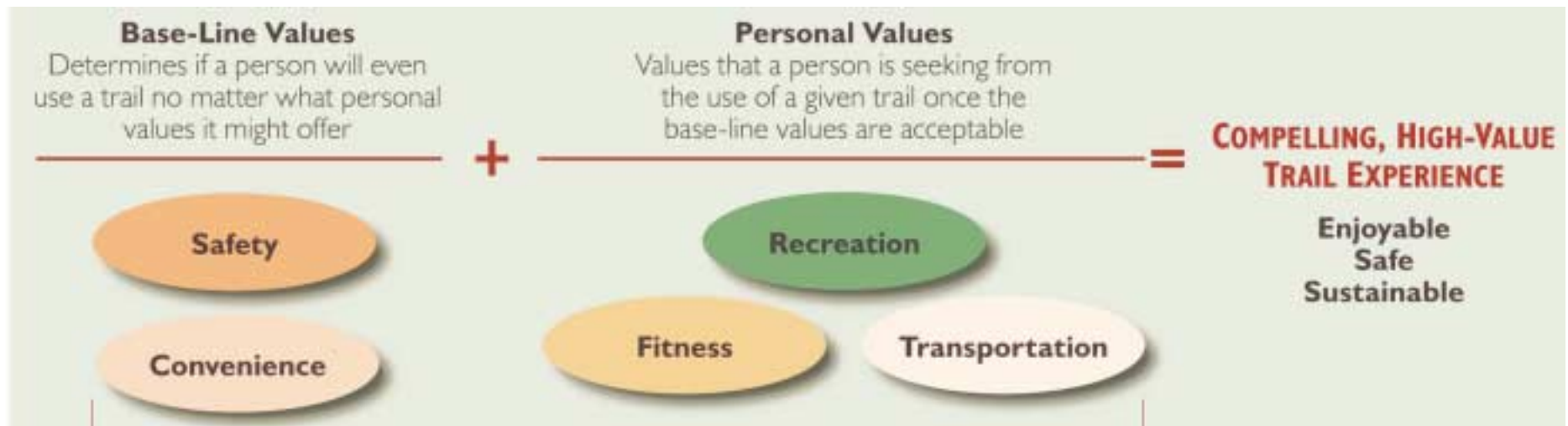
Sustainability is a function of:

- **Properly defining users and their expectations**
- Using sound techniques for designing specific types of trails
- Respecting the nuances of ecological sustainability and the fact that all development, including trails, have an impact
- Using well-tested best practices to build trails

The MN DNR trails manual repeatedly underscores the importance of all of these factors in creating sustainable trails of all classifications

Principles of Designing Quality Recreational Trails

Paying attention to user values is important to creating enjoyable, safe, and sustainable trails that engender stewardship



People tend to use and take care of what they value ... so design quality does indeed matter!

Example User Profiles – Paved Trail

The needs and expectations can be quite different between trail users!

Trail Use Pattern

Recreation Setting Preferences

Motivation/Activity Style Elements

BICYCLISTS PROFILES

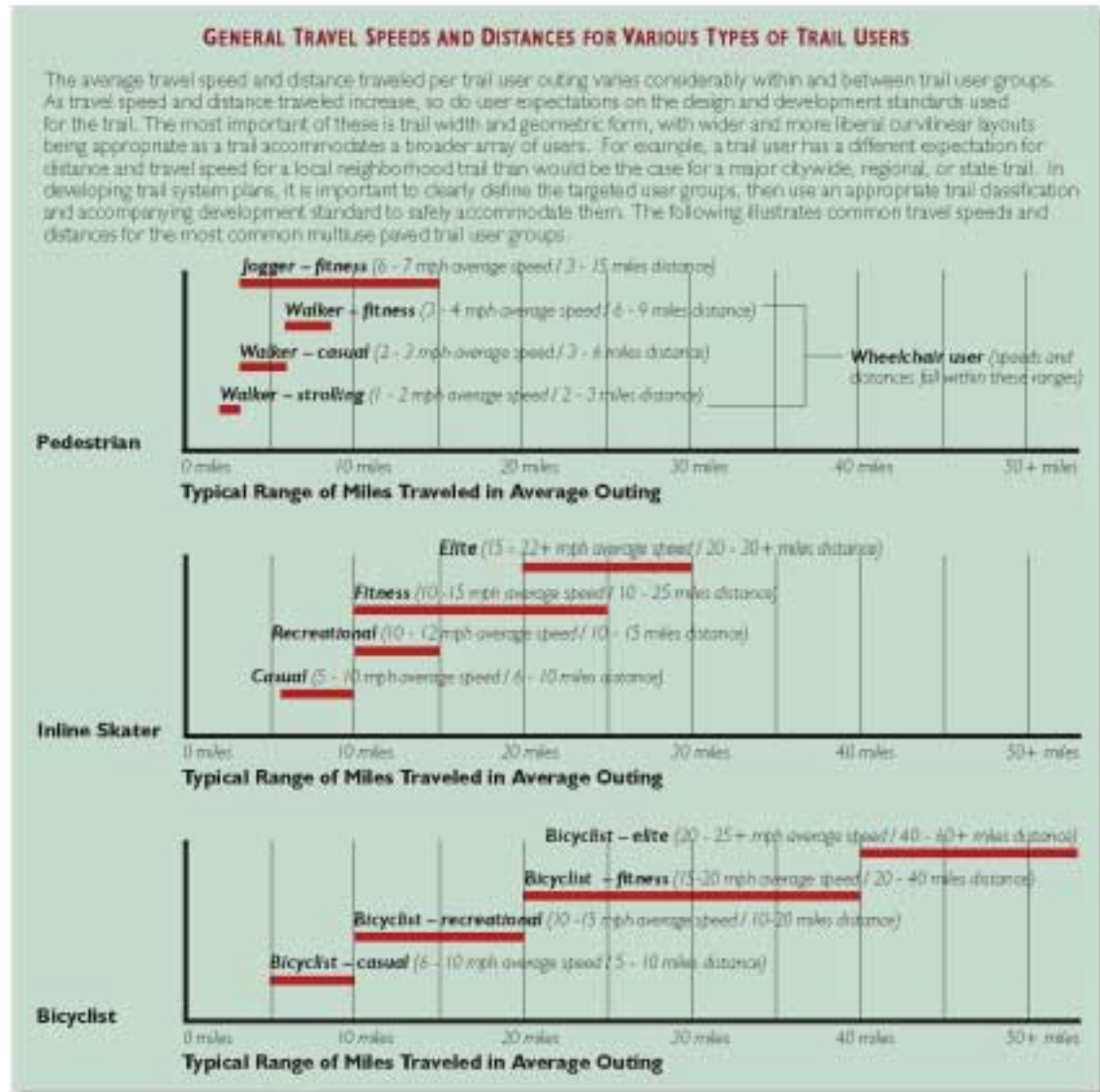
The following profiles were compiled from various sources, particularly the Profiles of Trail User Populations – Minnesota Border to Border Trail Study (DNR) to highlight the preferences of typical bicyclists.

Type	Preference Profile
Family Bicyclist	<p>Trail Use Patterns:</p> <ul style="list-style-type: none"> • Prefer local and quiet streets (to avoid heavy traffic), with preference for trails if conveniently located • Most trails are used close to home, but will also use trails extensively on vacation <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> • Quality of the riding experience is most important consideration • Length of trail is of primary importance, with length being secondary (20 miles maximum) • Comfortable trail and surroundings are important <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> • Often use trails with young children • Need good information for planning trips and access to support facilities (rest areas, parking lots, water sources) and prefers restrooms to portable toilets • Prefer scenic areas but no challenging terrain, especially when children are along
Recreational Bicyclist	<p>Trail Use Patterns:</p> <ul style="list-style-type: none"> • Travels out and travels to trail and bicycle-friendly areas away from home, either as a day or overnight trip • Prefer trails, but will also use roads that are safe, convenient, and not too busy <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> • Trails shorter than 10 miles are not very desirable for repeat use; 20 miles is the desired minimum • Looped configurations of varying lengths are preferred over out and back systems • Scenic value and an interesting experience are important, with riders seeking places with scenic quality and interesting natural or (if in urban setting) built forms <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> • Many seek escape from motorized traffic and value experiencing nature • Regards bicycling as an important recreational interest and is willing to make an investment in equipment • Often uses amenities, such as parks and rest areas, along the trail • As a group, interested in varying levels of trail difficulty • Destinations at reasonable distances are important to maintaining interest in a given trail
Fitness Bicyclist	<p>Trail Use Patterns:</p> <ul style="list-style-type: none"> • Will use a combination of roads and trails that are long and/or challenging enough for a good workout • Prefer trails if they are long enough (20 or more miles) and allow for faster speeds with minimal user conflicts • Will routinely use the same routes for challenge and timing, often daily <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> • Trails need to offer varying difficulty and lengths; interconnected loops are highly preferred • Not primarily motivated by experiencing natural setting, but will select the type of trail if other requirements are met <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> • Uses bicycle as primary form of exercise to maintain and improve health • Primarily rides alone or in small groups and often rides multiple times per week • Frequently extends the season by riding earlier in spring and later in the fall than recreational riders
Transportation Bicyclist	<p>Trail Use Patterns:</p> <ul style="list-style-type: none"> • Not dependent on trails, but will use them if convenient, safe, and direct <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> • Bicycle is used as a form of transportation, motivation is fitness, environmental values, and economy • Lack of a safe "system" of roads (with bike lanes or routes) and trails is a major barrier • Trail design is critical, with ability to go fast with good sightlines and directness being most important

User Profiles – Paved Trail

User profiles help define the physical design requirements for a given trail

Ignoring them will diminish the trail's value



Trail Classifications

Trail classifications help discriminate between different types of trail users

.... and help ensure that the trail that is built will actually meet the needs of the intended user group(s)

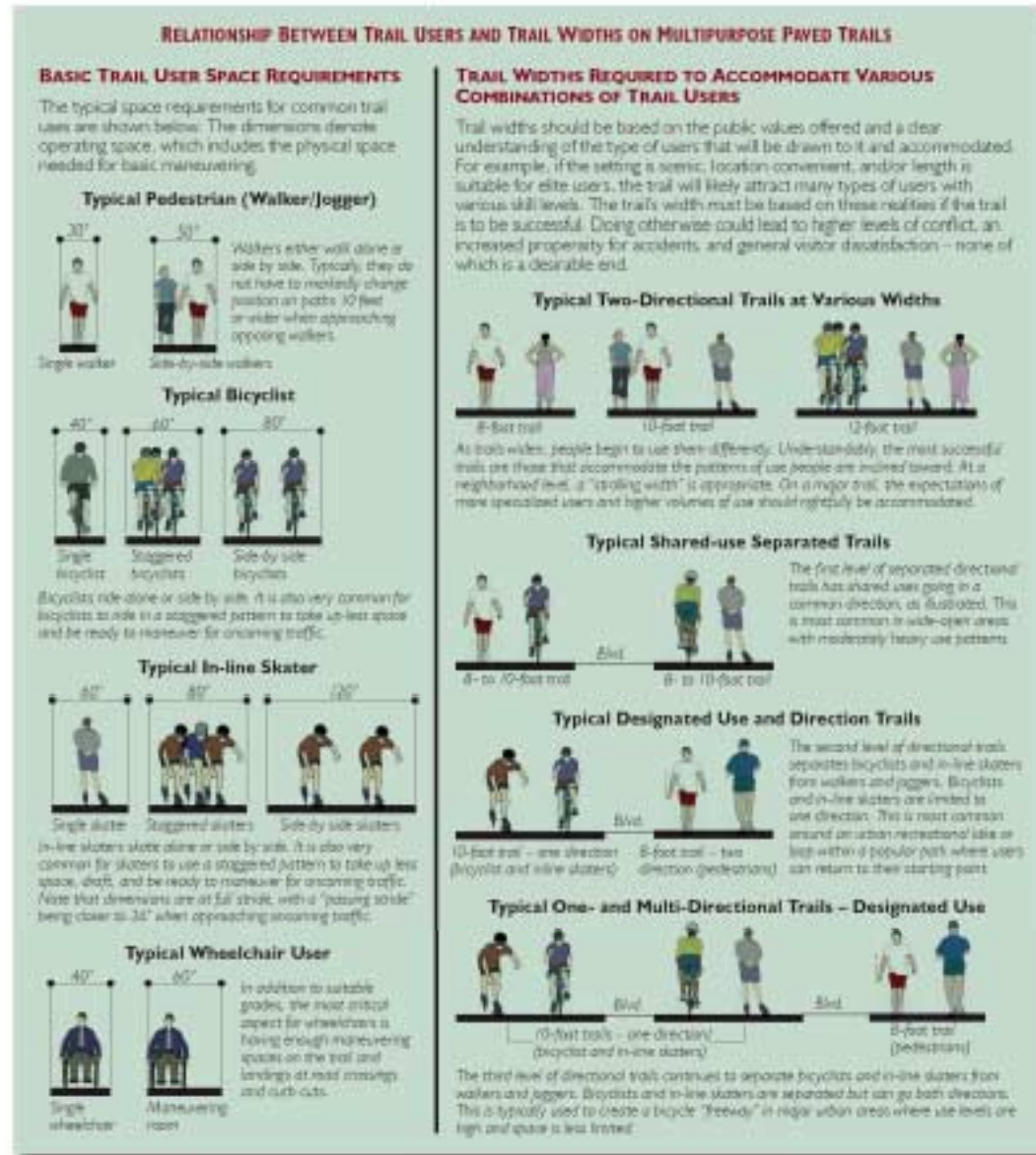


Hierarchy of Trails to Accommodate User Profiles

Within each classification, there are other standards to consider

Paved trails:

- ❑ Neighborhood trail
- ❑ City-County trail
- ❑ Regional trail
- ❑ State trail



Sub-Classifications – Shared-Use Paved Trail

Destination trail classification reflects focus on quality and recreational



.... while linking trails offer less recreational value (and often result in less use)



Example: Oak Grove



Example: Oak Grove



Elements of Quality Trail Design

To keep users content, the trail design must:



- Create compelling sequences
- Manage viewsheds
- Be shaped (laid out) consistent with user expectations

All elements of design need to be used to full advantage in creating fun, sustainable trails

ELEMENTS OF DESIGN USED TO CREATE TRAIL SEQUENCES



Defining and linking together the key elements of design creates compelling experiences that will keep trail users interested in a trail and encourage personal stewardship.

LANDSCAPE ANCHORS





Landscapes anchors can be as simple as trees and rocks that provide context and a visually pleasing experience in keeping with the setting.

GATEWAYS



Gateways can be created by natural terrain and features (left) or artificial structures that create a sense of entrance (right).



Elements of Design are Woven Together to Create a Compelling Sequence of Events With Spatial Diversity and Managed Viewsheds



The best trail design leaves no detail to chance. The more attention given to understanding and incorporating the nuances of a site into the design of a trail, the more compelling and enjoyable the experience will be for the trail user!

EDGES

The character of this dirt trail (left) comes from its natural shape and association with a vegetation edge. With the paved-use power trail (right), the gentle curves play upon the edge effect in subtle way that a much more interesting than a straight line.

TERMINUS POINTS/DESTINATIONS

Terminus points and destinations can be scenic or cultural (top) or a compelling natural scene (bottom) that entices a trail user to continue on.

Technical Design – Vital to Long-Term Sustainability

Adhering to sound technical practices and designing around the target user groups is critical to success and sustainability

TRAIL WIDTHS AND CONFIGURATIONS
The width of a trail should be based on the intended use, the number of users, and the terrain. For more information, see the American Planning Association's *Trail Design Handbook*.

Curb ramps are outside of approaching trail



Maintaining trail width through curb cut.

Trail users should not have to change their alignment when traveling through a curb cut. This is especially important on busy trails where numerous trail users can congregate at a crossing and want to get across the ramp at the same time.

Should be less than 2' wide



This curb cut is not wide enough for bicyclists, in-line skaters, and walkers to maintain their line of travel through the ramp, creating the potential for conflict and congestion. The bottom of the ramp should match the width of the trail. Notice the location of the 2-foot wide detectable warning strip (as compared to the below photo).



Shifting Gears – ATV Trails

Understanding the expectations of the trail user is especially important with OHV trails

ATV riders often seek very different experiences:

- ❑ Recreational Rider
- ❑ Long Distance Rider
- ❑ Technical Challenge Rider
- ❑ Local Access/Utility Rider
- ❑ Excitement Seeker/Careless Rider

design information for this type of trail

ATV TRAIL RIDER PROFILES

The following profiles were compiled from various sources, particularly the Profile of Trail User Populations – Minnesota Border to Border Trail Study (DNR).

Type of Rider	Preference Profile
Recreational Trail Rider	<p>Trail Use Pattern:</p> <ul style="list-style-type: none"> Travels to trails and ATV areas to ride designated trails and road systems <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> Natural setting is an important element of experience, with highly technical areas a secondary attraction Prefers looped configurations with varying conditions Natural, hilly areas make for the best trails, with long, straight trails found to be boring <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> ATV is a source of escape to natural settings Seeking challenge to machines and operating skill Highly social activity, with groups consisting of family and friends Will often travel long distances to a trail if it is publicized
Long Distance Tourer	<p>Trail Use Pattern:</p> <ul style="list-style-type: none"> Rides long distances from place to place (used extensive trail and forest road system) Prefers loop system, but will use out and back if no other choice <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> Seeks challenges with a variety of conditions with obstacles and technical requirements – although not all of the trail should be highly difficult so groups can stay together Technical challenges should include hills, trees, logs, rocks, and winding configurations Needs access to local services, lodging, restaurants, and businesses (40 to 60 miles max range on a tank of gas) Will use ditches and local trails to connect trails Frequently rides in unfamiliar areas, requiring maps, signs, and other information about trail systems <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> Commonly in family groups or with close friends Travels on machines much like snowmobiles Tends to travel slow, wanting to see the countryside; not very interested in speed and performance
Technical Challenge Rider	<p>Trail Use Pattern:</p> <ul style="list-style-type: none"> Needs a relatively small area, with 2 acres being the maximum size required (trails are not used for this activity) Only a small number of riders use these areas as a main part of the sport <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> Prefers short, wet hills or hilly terrain that challenges machine capabilities and rider skill Natural setting is not important, with riding challenge being the most important site selection criterion <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> Participates in groups in this highly social activity, often taking part in events and rallies where allowed Most riders stop after several times around the area and then spend most of their time as trail riders
Local Access/Utilitarian Rider	<p>Trail Use Pattern:</p> <ul style="list-style-type: none"> Starts trips from and return to home, with wide-ranging trip length depending on purpose for ride Knows and rides the local forest road and trail system, but also frequently rides on road rights-of-way, private land, and other public lands as necessary to get to destination <p>Recreation Setting Preferences:</p> <ul style="list-style-type: none"> Requires little or no developed trail system and uses roads and trails for convenience in getting around <p>Motivation/Activity Style Elements:</p> <ul style="list-style-type: none"> Does not necessarily consider self a recreational rider; often rides for utilitarian purposes (hunting, fishing, working in the woods, traveling to and from specific destinations) – convenience of travel is key motivation
Excitement Seeker/Careless Rider	<p>In each of the above segments, excitement seekers and careless riders may be source of behavior problems, creating safety concerns and presenting a bad public image for the type of activity. This is a major concern of many responsible OHV riders.</p>

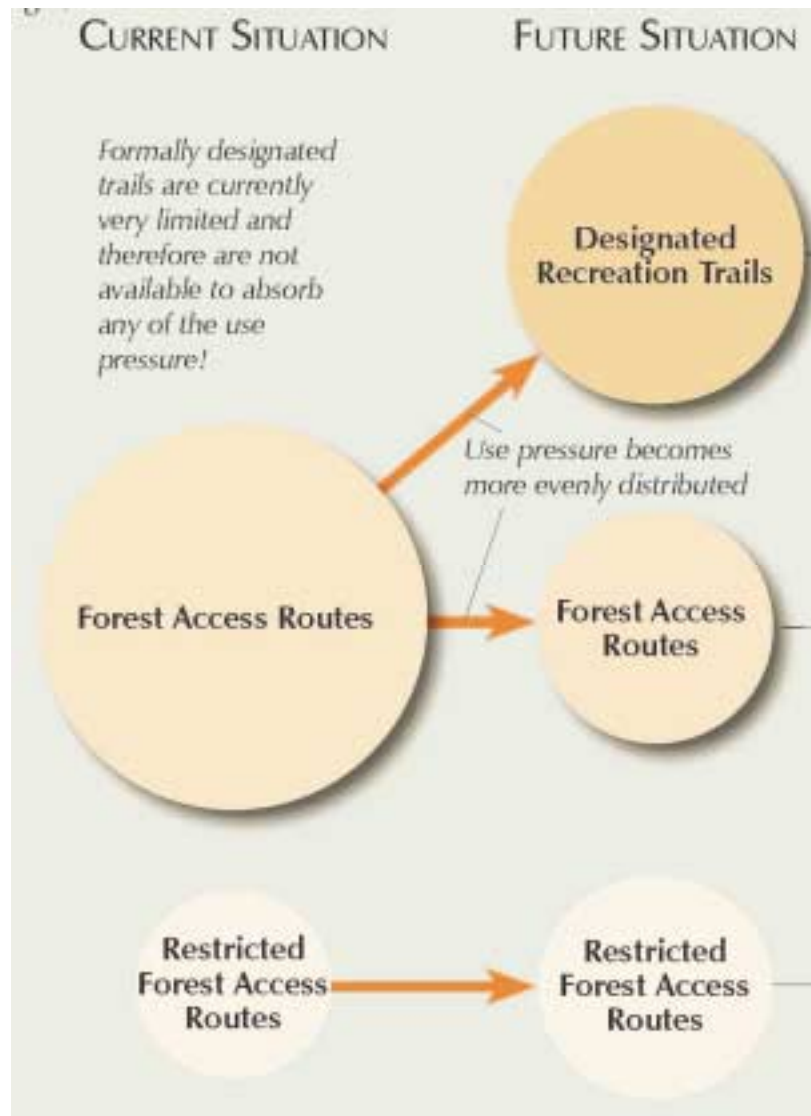
OHV Classifications

OHV classifications helps inform the type of trails needed in a system to meet user demand and foster sustainability



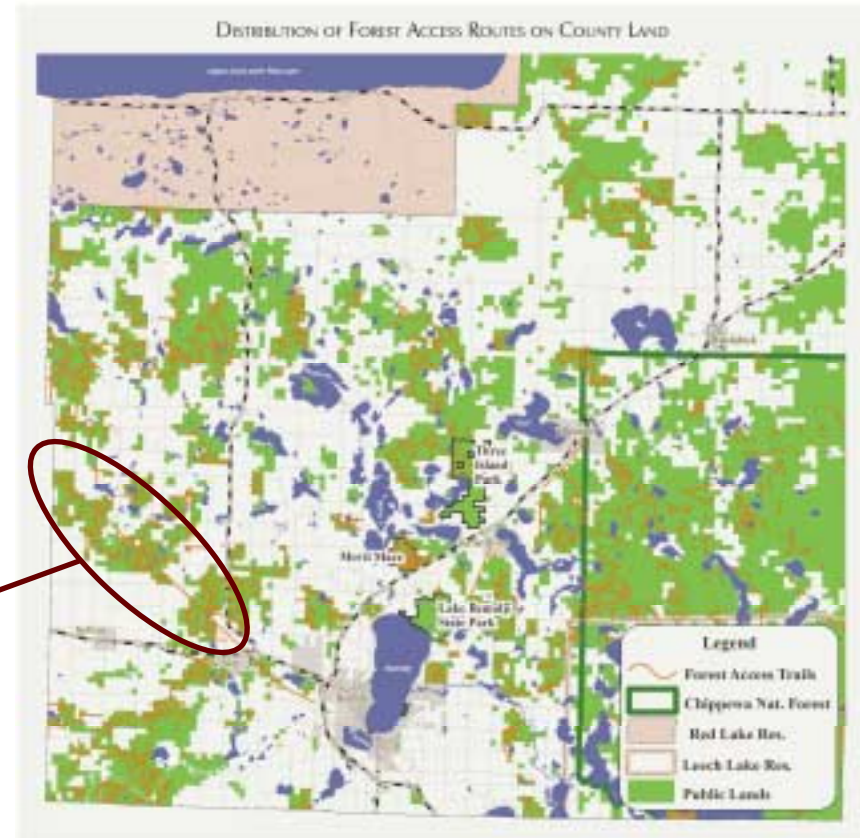
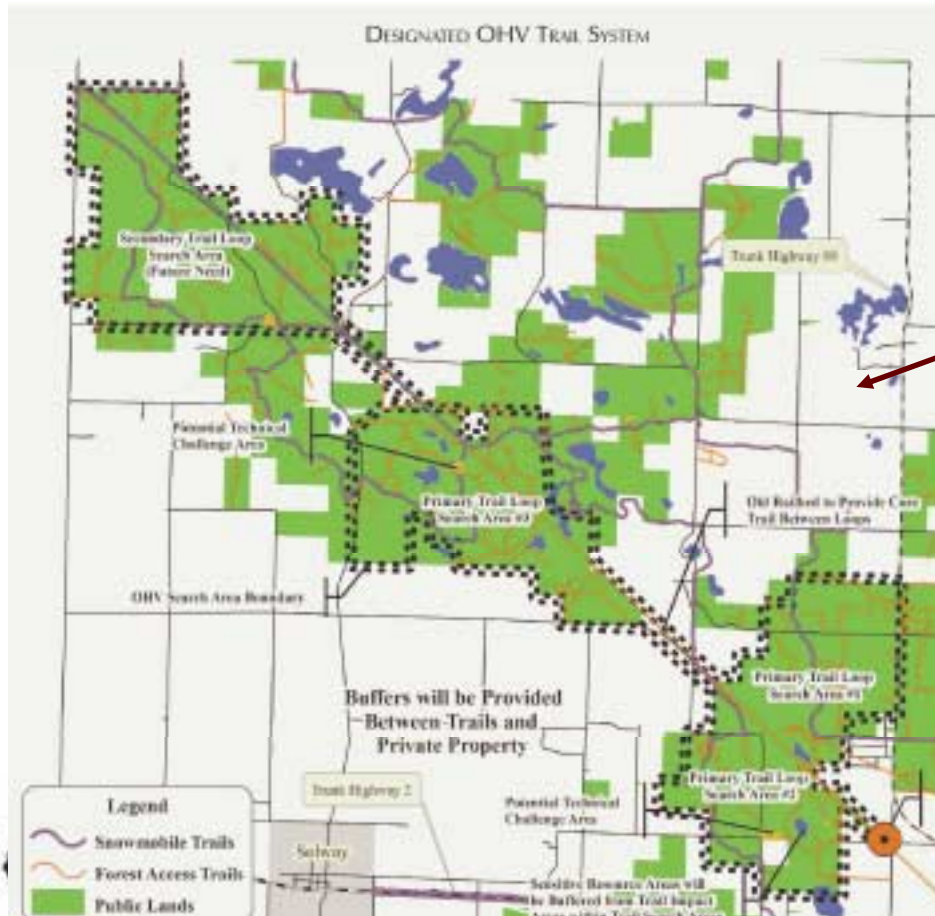
Example: Beltrami County, Northern Minnesota

OHV trail classifications were used as a means to accommodate all user groups in a more sustainable manner



Example: Beltrami County, Northern Minnesota

Intent is to shift ATV use level and intensity out of the forest over to a designated OHV site



..... then hold users accountable for actions and to retain the privilege of riding in the forest

Example: Beltrami County, Northern Minnesota

Outcomes of reasonably accommodating OHV trail users:

- More aggressive users become more confined and manageable
- User's sense of responsibility goes up
- Peer pressure can be leveraged to help enforce rules

To leverage peer pressure, responsible users have to be reasonably accommodated and be part of the process not outside it and thus being perceived as “part of the problem”

In turn, responsible users will be more diligent in exerting pressure on abusers in order to preserve their privilege!

Example: Beltrami County, Northern Minnesota

Shifting uses from one trail opportunity to another will only be successful if there is adequate reason for an OHV rider to change their habits – **which centers directly on the quality of the experience**



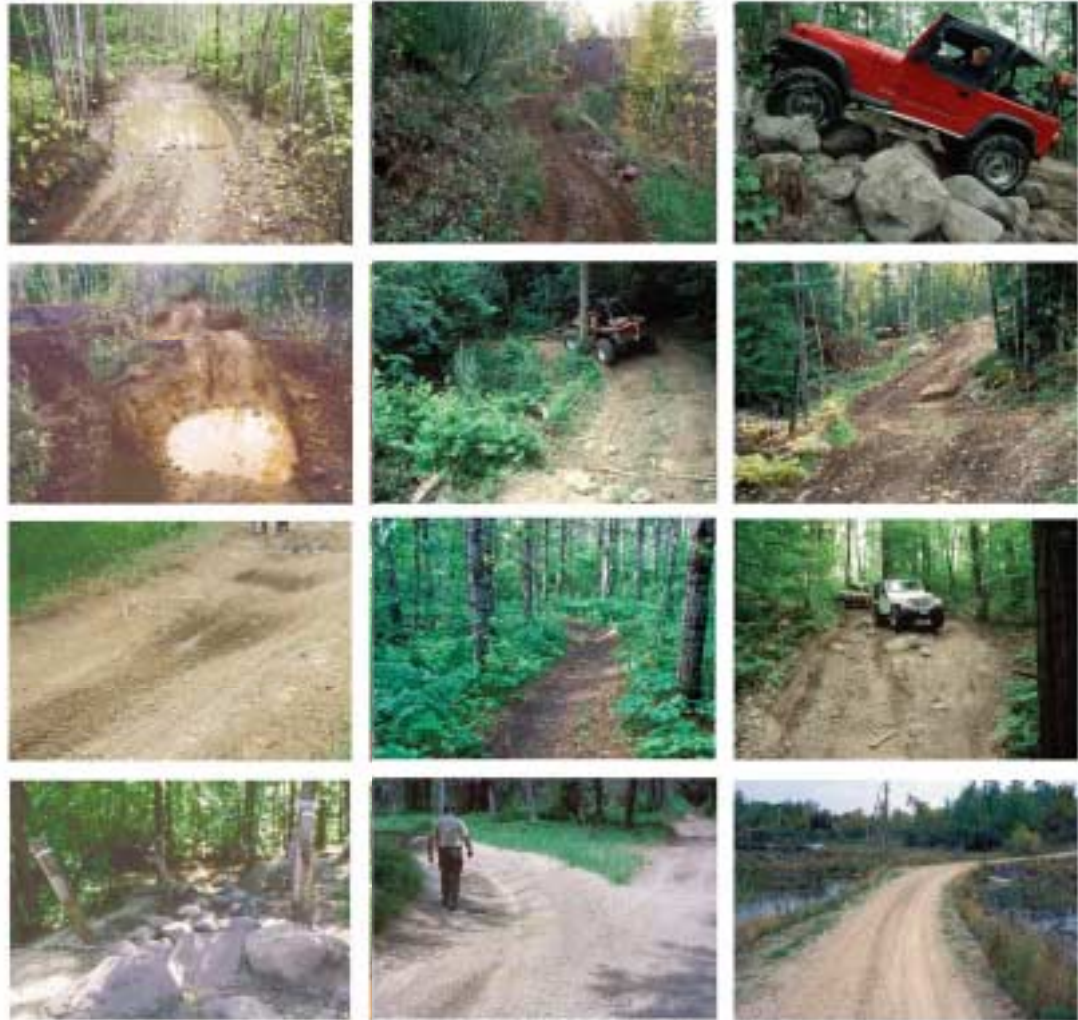
Example – OHV Trails

Attention to detail matters.... without which controlling use and tangential ecological impacts becomes much less assured

This....



versus →



Technical Design – Vital to Long-Term Sustainability

Proper use of rolling grade ensures a trail will be interesting and sustainable

OVERVIEW OF ROLLING GRADE AS THE PRIMARY DESIGN PATTERN FOR NATURAL SURFACE TRAILS

Rolling grade is the primary pattern for designing and building natural surface trails. Rolling grade trails are a series of tread dips, crests, climbs, drainage crossings, and edge buffers. In this illustration, rolling grade is used for portions of a trail traversing a sideslope.

Sideslope (fall line slope). Rolling grade is most effective when the trail is traversing slopes of 20% to 70%. On sideslopes of less than 20%, draining dips becomes more difficult. On sideslopes greater than 70%, traversing the slope with a trail becomes too difficult.

Tread grades. Rolling grade is most effective when tread grade is less than 1/4 to 1/3 of the sideslope (fall-line slope). To avoid drainage problems, no part of the trail should be completely level.

Tread dip. Local low point that drains tread runoff to the downslope side.

Tread crest. Local high points that divide the trail into separate tread segments for drainage control.

Hardened tread. Used where native soils and rolling grade techniques cannot be effective.

Sustainable native tread. Shaped from native soil and rock.

Drainage crossing. All natural drainage channels and swales, no matter how small or intermittent, are crossed with a tread dip. This ensures that site drainage continues on its original course instead of being intercepted and diverted down the trail, resulting in erosion problems.

Tread climb. The steepness and length of the tread is determined by the soil type, type of trail use, and site drainage characteristics.

Edge buffer. Refers to an optional berm or shoulder on the outside edge of the tread. Used to increase the sense of visitor safety on steeper sideslopes. Also relates to general clearance guidelines.



Guiding Principles of Ecologically Sustainable Trails

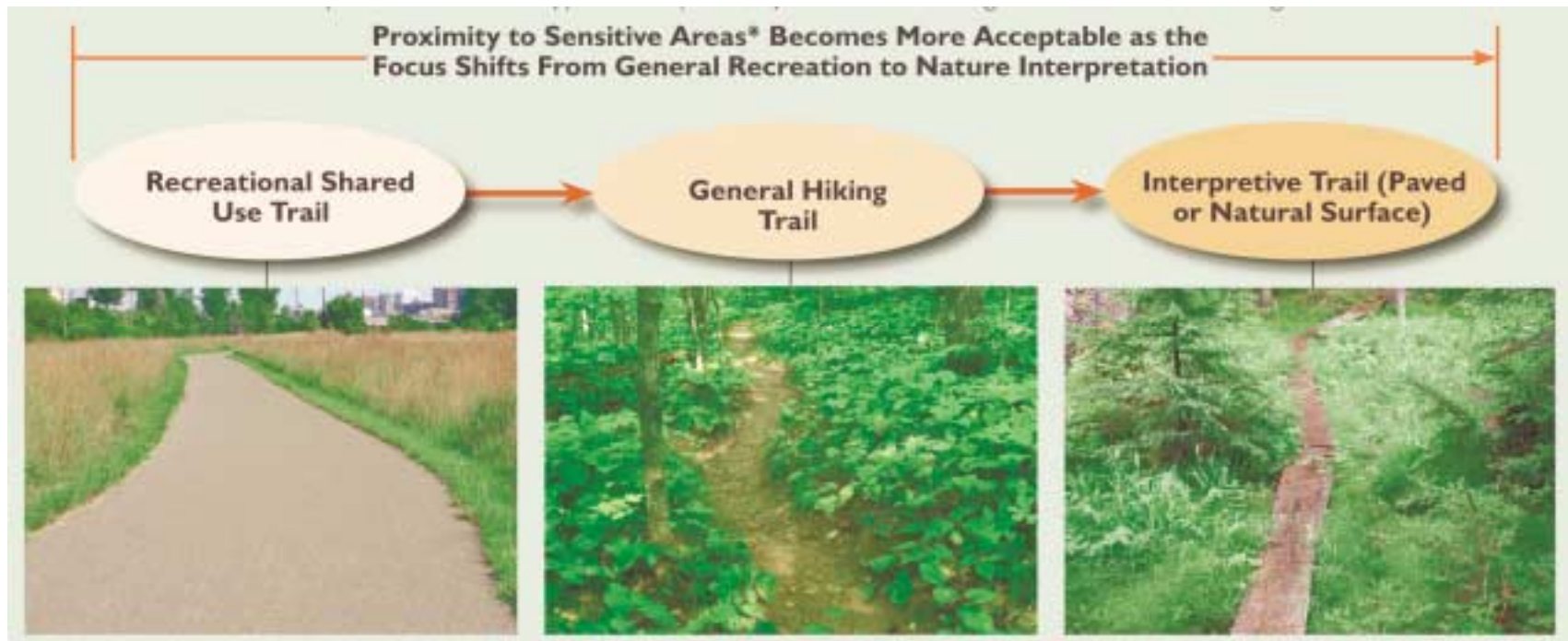
Guiding principles provide the underlying rationale for actions related to protecting, restoring, and managing natural environments associated with trail development

**ADHERENCE TO THESE PRINCIPLES
WILL ENSURE ECOLOGICAL
SUSTAINABILITY**



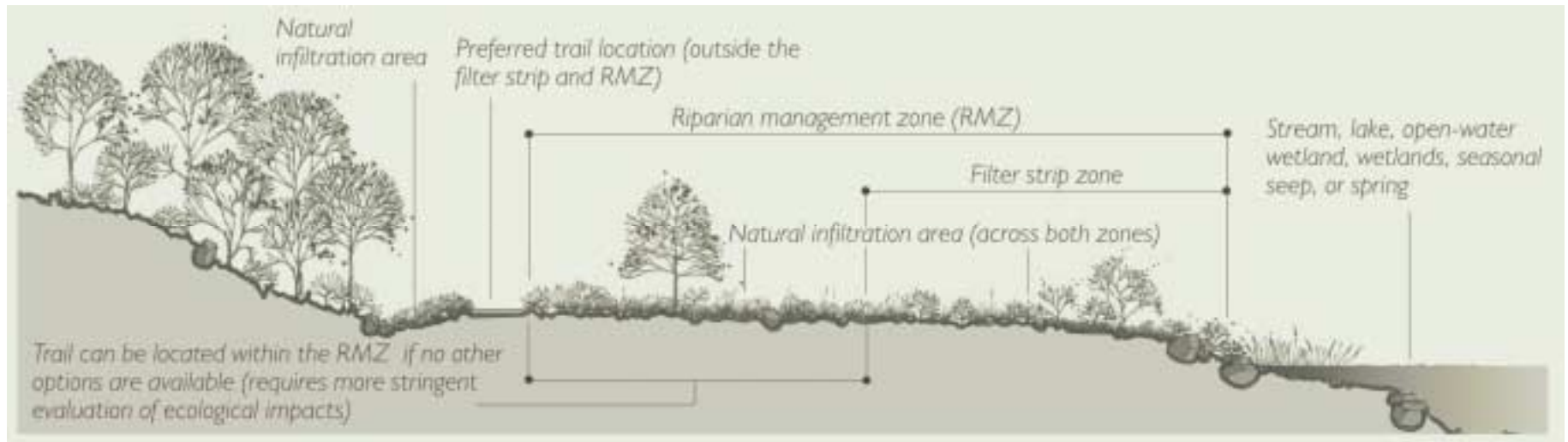
#2 – Trails in Areas Already Influenced by Humans

Trail type and site circumstances affect a trail's location in relation to sensitive ecological areas



#3 – Provide Buffers to Avoid/Protect Ecological Systems

The use of buffers is important to limit ecological impacts – especially trails prone to erosion and increased site runoff

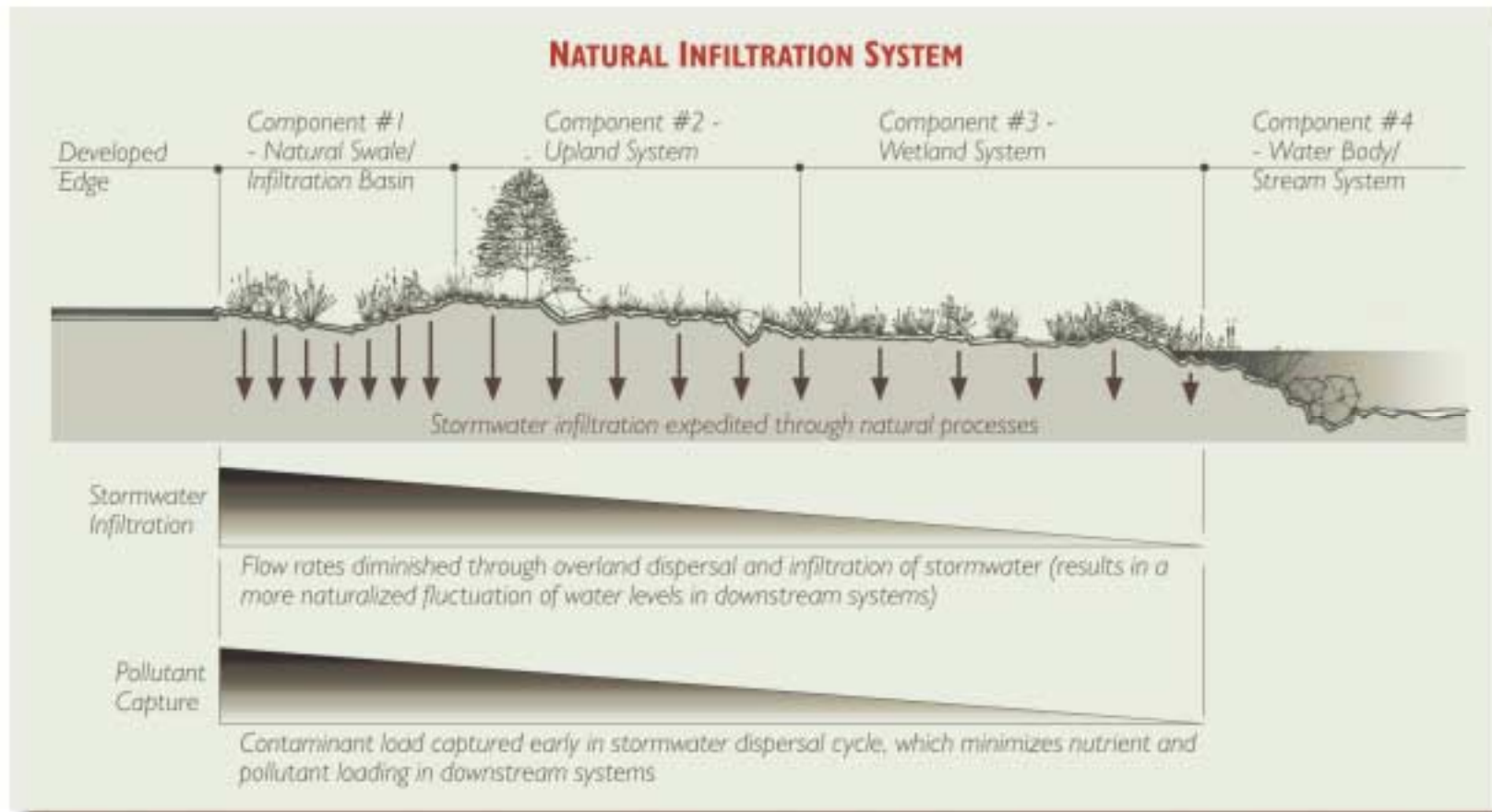


#3 – Provide Buffers to Avoid/Protect Ecological Systems



#4 – Use Natural Infiltration for Stormwater Management

Managing stormwater is one of the most important trail development considerations



#5 – Provide Ongoing Stewardship

The level of stewardship that will be provided should be defined during the planning and design phase because it will affect outcomes



#6 – Ensure that Trails Remain Sustainable

All design, management, and maintenance factors influencing a trail's sustainability need to be carefully considered and defined during the planning phase



#6 – Ensure that Trails Remain Sustainable (cont.)

Thresholds provide a sense of clarity in determining if a trail is sustainable

Each threshold triggers a predetermined action



#6 – Ensure that Trails Remain Sustainable (cont.)

Sustainable use -
no action needed



Forest access routes must be well suited for the use to remain sustainable. Especially since these are natural management areas, similar status is the typical result if these routes prove unsuitable.



Felling grade design and alignment ensures that the ATP trail will remain sustainable. Careful alignment through dips and crests, erosion can be largely prevented with normal use.



A superintended curve plus embedded rocks help ensure that this recreation feller trail will remain sustainable. In high concentrations, like this, an oval to crossing trail that turns inside areas of heavy use.



This sustainably designed trail naturally follows site contours, which also make the trail more appealing. Notice the trail changes dip feet above water off the trail (to the left).



Sustainable forest access route. The grass on this lightly used trail will help keep it sustainable, perhaps over decades.



Although the DAM trail is a fairly narrow-use trail, systematic alignment on the curve has formed a superintended curve that allows further displacement. Since the tread remains porous and the site has only gentle slopes, erosion is not a problem and trail is sustainable.

#6 – Ensure that Trails Remain Sustainable (cont.)

Questionable use
– action required



Problem: Trail creep. The low spot on a mountain side trail is gradually widening, forcing trail users to go around it. Careful or removal of the existing path next to a bank that is necessary to avoid additional expansion of the trail.



Problem: Soil rutting. With heavy traffic, trail creep can become a sustainability issue. If this is limited to an occasional stretch, no major action is needed. But if this problem persists over a significant distance, regrading or closure may be necessary.



Problem: Lack of underlying soil stability. Organic soils are inherently prone to rutting. Although soil under existing trails, the trail is prone to becoming increasingly unstable, especially if soil height is eroded to adjacent (under) soil water tables. If the soil is too porous, reroading and filling may be the best approach if the problem continues, reroading may be necessary.



Problem: Exposing trail boundaries. Even a few ruts and ruts in a trail can cause trail users to find another route. Left unchecked, the top of a rut can slowly detach from the trail alignment and the rut will widen. Large gear anchors (and "tree as trail" signs) can be used to keep the flow going west.



Problem: Erosion due to full-line alignment. In both of these cases, the soil follows the full line (i.e., is aligned straight up the slope), posing an opportunity for erosion. In the left photo, erosion is becoming a problem and soil is eroding to the base of the slope. If geotechnical information is available, the trail could remain temporarily to the left, although a better solution is to regrade. In the right photo, because of a forest canopy, the trail is clearly becoming an issue with increasing use and exposure to the elements. Regrading or closure of the segment will ultimately be necessary to keep the trail sustainable.



#6 – Ensure that Trails Remain Sustainable (cont.)

Unsustainable use
– action mandated



Problem: Compacted and displaced trail in lowland area makes the trail unusable. Altering to drive the trail would cause the entire area unsuitability changing the trail type at an adjacent section. Rerouting or closure of the trail is necessary.



Problem: Severe soil erosion adjacent to a hillside due to poor trail design. This will intensify continue and cause increasing levels of streambank erosion. Rerouting or closure of the trail is necessary.



Problem: The ATV trail goes across a shallow drainage that has been deepened through use. This will continue until the hole is too deep to go through. An ATV will have to be driven the area, which will cause further problems. Practice rerouting to the less suitable although closure might be necessary if the problem is persistent in the area.



Problem: Compaction and displacement on a new trail site deepening the trail of this relatively new ATV trail. Water runoff will be increased if it is the lowest point. Towing the problem by improving drainage and perhaps hardening the trail through the section are possible solutions.



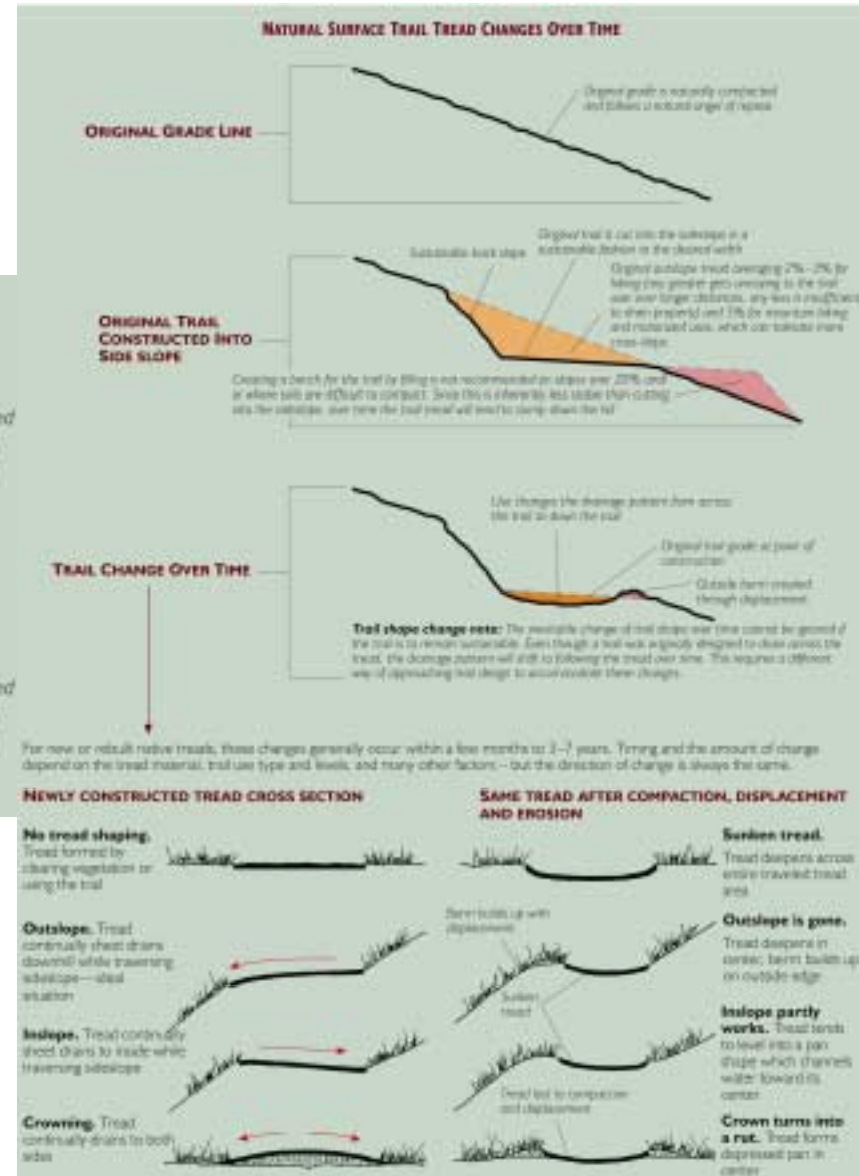
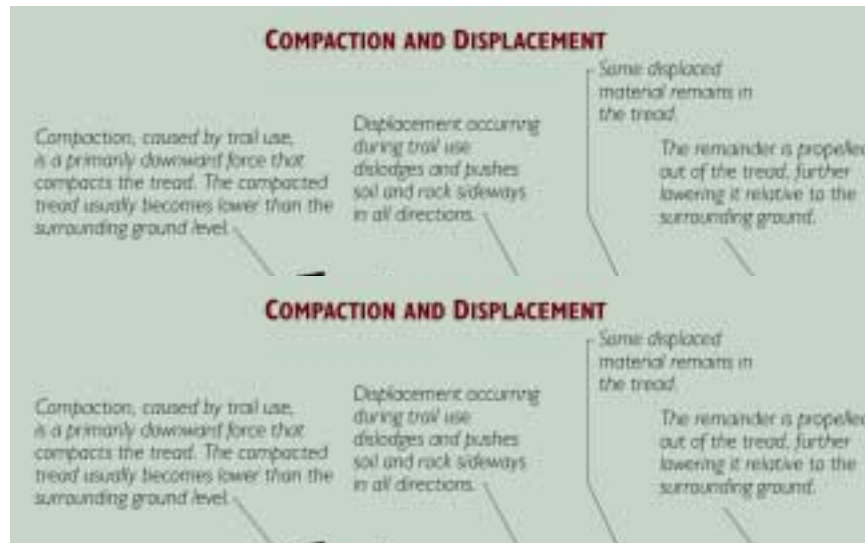
Problem: Trail rutted. If overgrown areas burn and will be left undisturbed, it is a risk that a trail will keep expanding until new options will be created. These problems are common in areas of erosion, with a lot of water there is no real change. Rerouting or practice rerouting to the less suitable. Where that is not possible, consider arguments using riding grade techniques used in a low to deep ruts on the trail can help reduce problems.



Problem: Severe, ongoing erosion on a roadless slope. Considering the through characteristics of a site is a prescription for the kind of problem. The trail will have to be redesigned using riding grade techniques if it is to be sustainable. Otherwise, closure will ultimately be necessary as the problem gets worse.

Technical Design – Vital to Long-Term Sustainability

Anticipating how trails change over time must be factored into their initial design





MN DNR Trail Guidelines

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Thank you!