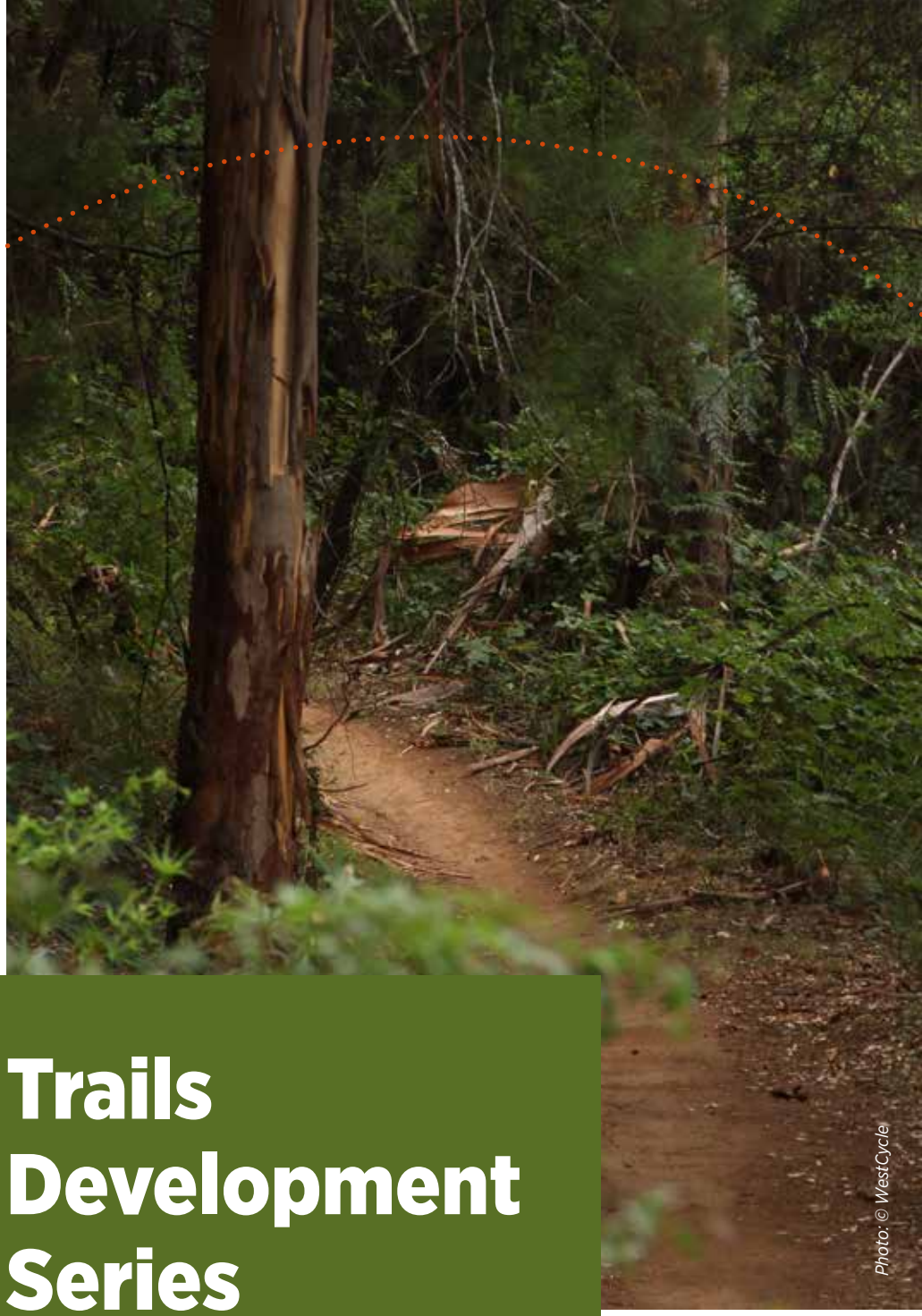

Photo: © WestCycle

Trails Development Series

Part C: A Guide to Using Multi-Criteria Decision Analysis (MCDA)

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Department of **Local Government, Sport and Cultural Industries**

A joint publication by the Department of Biodiversity, Conservation and Attractions and the Department of Local Government, Sport and Cultural Industries. This publication is current at August 2019.

Department of Biodiversity, Conservation and Attractions

17 Dick Perry Ave, Kensington WA 6151

Locked Bag 104, Bentley Delivery Centre WA 6983

Email: enquiries@dbca.wa.gov.au
Website: www.dbca.wa.gov.au

Department of Local Government, Sport and Cultural Industries

Perth Office
Gordon Stephenson House
140 William Street, Perth WA 6000

Leederville Office
246 Vincent Street, Leederville WA 6007

GPO Box 8349, Perth Business Centre WA 6849

Email: info@dlgsc.wa.gov.au
Website: www.dlgsc.wa.gov.au

This document is presented in four parts with each part available for download in PDF format from:
https://pws.dbca.wa.gov.au/management/trails

ISBN: 978-1-921648-60-1

Contents

Foreword C2

Introduction C4
The benefits of using MCDA during the Trail Development Process C4

How to use MCDA in the Trail Development Process C5

How to run an MCDA workshop C7
How to plan the workshop C7
On the day — Introducing the workshop C9
Hypothetical Trail Proposal C10
MCDA Step 1 — Determine the relevant values C11
MCDA Step 2 — Agree on the relative weightings of the three pillars C13
MCDA Step 3 — Determine the weightings of individual values C14
MCDA Step 4 — Create a scoring system for the individual values C15
MCDA Step 5 — Calculate the weighted scores for each value and pillar C16
MCDA Step 6 — Calculating the 'normalised' scores for each pillar for each proposal C18
MCDA Step 7 — Final calculation of total combined scores for each proposal C21
MCDA Step 8 — Final discussion and recommendations C23

Purpose of the document

The Trails Development Series is presented in four parts:

- **Part A: A Guide to the Trail Development Process**
- **Part B: A Guide to Community Consultation**
- **Part C: A Guide to using Multi-Criteria Decision Analysis (MCDA)**
- **Part D: Checklists and Templates**

This document is Part C in the series and provides a step-by-step guide to developing a participatory approach to discussion and decision making at various stages of the Trail Development Process.

The Trails Development Series has drawn extensively on:

- Chapter 10 of the *Western Australian Mountain Bike Management Guidelines* (2018), developed by DBCA in collaboration with DLGSC, WestCycle and the Western Australian Mountain Bike Association;
- *Trail Development Protocol and Sustainability Framework for Western Australia*, developed by Dafydd Davis for DBCA and DLGSC; and
- A report developed for DLGSC by Curtin University's Centre for Sport and Recreation Research, *Application of Multi-Criteria Decision Analysis for recreational trails decision making in Western Australia: Final technical report*, by Middle, I., Hughes, M., Middle, G. and Ty, M., Centre for Sport and Recreation Research, Curtin University, Perth, April 2017.

Introduction

Trail development projects can face various difficulties including:

- Identifying and recognising the range of views and values that different stakeholders hold
- Comparing possible impacts on values from different trail proposals
- Considering the relative importance of impacts on different values.

In such situations, a structured approach to support discussion and decision-making can be invaluable. Multi-Criteria Decision Analysis, or MCDA (also called multi-criteria analysis, multi-criteria decision-making and multi-criteria assessment) has a long history of use in support of environmental management and decision-making.[1]

MCDA is a participatory process involving key stakeholders working together in a collaborative atmosphere to consider multiple values of landscapes and land uses. The MCDA framework can incorporate diverse views about a trail proposal and provides a process for participants to determine the relative importance of different values in assessing the proposal. This understanding and discussion among stakeholders can help build agreement as well as identify options to mitigate impacts on critical values. As a result, the Trail Development Process has a greater chance of developing a proposal that will be supported among stakeholders and progressed.

Because the process does not require significant resources or large amounts of data it can be cost-effective, time and resource efficient and can generate a robust outcome based on informed expert and stakeholder opinion.

Development of the MCDA process for trails decision-making involved collaboration between several State government agencies, including:

- Department of Local Government, Sport and Cultural Industries
- Department of Biodiversity, Conservation and Attractions
- Department of Water and Environmental Regulation
- Department of Mines and Petroleum
- Forest Products Commission.

A workshop to test the process using a hypothetical example, was attended by representatives of all partner agencies, selected local governments, and trails organisations.

The benefits of using MCDA during the Trail Development Process

MCDA offers numerous benefits in situations where there are multiple stakeholders with different strongly held views. These benefits include:

- Providing a structured process
- Allowing for diverse subjective positions and values to be expressed, acknowledged, and prioritised as part of the process
- Being able to assign different weightings to different values to reflect stakeholder views
- Capturing all views and deliberations in the final recommendations to support decision-making.

1. Information provided about the MCDA process is based on a report developed by the Curtin University Centre for Sport and Recreation Research (CSSR):

Middle, I., Hughes, M., Middle, G. and Tye, M. *Application of Multi-Criteria Decision Analysis for recreational trails decision making in Western Australia: Final technical report.* Centre for Sport and Recreation Research, Curtin University, Perth, April 2017.

How to use MCDA in the Trail Development Process

An MCDA process and workshop can support decision-making at Stage 4: Concept Planning of the Trail Development Process. The MCDA discussion can help identify a preferred alternative out of various trail proposals. This information can then be referred back to the Steering Group for completion of the planning process.

Information gathered during the MCDA process can also help the Steering Group understand impacts to be considered and specific values to be protected during the later design stages.

Figure 1: Where MCDA can support the Trail Development Process

The MCDA process can also usefully assist in generating additional alternatives where the impact on a particular value may be considered too significant, but an amended path alignment might make it acceptable. An MCDA could prompt participants to consider whether hybrid proposals might be acceptable, or if one proposal has an unacceptable level of impact on identified values that cannot be compensated by possible benefits for other values.

It is also possible to conduct the MCDA on a single proposal to determine the level of impacts on identified values. This can assist groups to determine:

- Unacceptable impacts on the most important values and therefore whether the proposal should progress further in current form
- What impacts will require mitigation and further investigation in later stages
- Where more 'value adding' is needed to create positive impacts.

Steps 6 and 7 allow for a more refined comparison of the FINAL total scoring of each proposal and may be of use where the scoring is very similar. However, for many groups, where the objective is to look at relative rankings between proposals or highest/lowest ranking of impacts on values, these steps are not essential.

Whilst numeric rankings are an important part of the process, it is important to remember that MCDA is not intended to arrive at a quantitative outcome where the proposal with the highest score is the best solution. All scores are simply indicative and provide a *relative comparison of impact, the importance of different values and can assist in the comparison of proposals.*

There is a total of eight steps in the MCDA process involving discussion and work to be done by small groups and the entire workshop group. Steps 6 and 7 are optional.

- Step 1 — Determination of relevant values
- Step 2 — Relative weighting of three pillars (social, environmental, and economic)
- Step 3 — Weighting individual values
- Step 4 — Scoring the values
- Step 5 — Calculating the weighted scores for each pillar
- Step 6 — Calculating the normalised scores for each pillar
- Step 7 — Calculation of relative scores for each proposal
- Step 8 — Final discussion and recommendations

It is important to remember that the proposal scoring highest overall may not necessarily end up being the preferred option because a focus on the total score can miss the nuances of different values and impacts. For this reason, the discussion component at Step 8 is essential as it helps the facilitator identify significant areas of agreement and disagreement. An overview of the group discussion should be provided to the Steering Group of the Trail Development Process to assist in decision-making.

This guide provides detailed instructions and a worked theoretical example to assist anyone wishing to hold an MCDA workshop as part of their Trail Development Process.

Scoring examples, based on a hypothetical trail proposal (presented on page C11), are provided in table form along with worked examples of calculations.

How to run an MCDA workshop

The best way to run the MCDA process is to arrange a half-day, three-hour workshop, and have it professionally facilitated. The independent facilitator will lead the participants through the eight steps of the process. The outcome is the identification of the group's recommended or preferred trail corridor, together with the supporting data to explain how the group made that determination. The recommendation can then inform the next stage of the Trail Development Process: Stage 6 — Detailed Design.

How to plan the workshop

Here are some of the important aspects in planning the workshop.

The invitation list

Identification of who should attend is crucial. All stakeholders with a connection to the proposed trail should be invited to attend. Stakeholders typically include:

- Key government agencies that have an interest in the proposed trail or the land in question
- Relevant local governments
- Community organisations
- Neighbours and other local residents or businesses
- Current and potential user groups of the land included in the proposal.

Review the stakeholders listed at Stage 1 of the Trail Development Process (and any stakeholders who may have emerged in subsequent stages) to identify who to invite. If there are specific individuals who need to be there, send the invitation directly to them. If an organisation needs to be represented, ask the organisation to nominate a suitable person to attend and request that the attendee be fully informed and able to present the organisation's views and information during the discussions.

Once the stakeholders have been identified, send out invitations to attend the workshop at least three weeks before the event. Specify an RSVP deadline at least 48 hours before the workshop.

Choosing the venue

Choose a venue that:

- Is close to the location of the proposal
- Has an electronic whiteboard (ideally) or a standard whiteboard
- Can comfortably accommodate the number of people attending
- Has facilities to serve light refreshments
- Has flexibility in room layout. The room should be set up with a number of tables, so participants can work in small groups.

Providing pre-reading for participants

About one week before the workshop, distribute an information pack and ask people to read it thoroughly before attending. The pack should contain:

- Background information about the trail proposal and the options being discussed at the workshop
- Information about the MCDA process
- The format for the workshop
- Any practical information about the venue such as directions and parking.

The format for the workshop

There are eight steps in the complete MCDA process (Table 1) with steps 6 and 7 being optional. Some of these steps will be done as a whole group discussion, and some will be small group discussions at each table. A morning or afternoon tea break can be scheduled during Steps 5–7 while the facilitators and/or workshop organiser 'crunch the numbers'.

Table 1: Steps in MCDA Process

MCDA process	Description	How done
Step 1	Determination of relevant values	**Whole group discussion**
Step 2	Relative weighting of three pillars (social, environmental, and economic)	
Step 3	Weighting individual values	**Small group discussion**
Step 4	Scoring the values	
Step 5	Calculating the weighted scores for each pillar	**Facilitator**
Step 6 (OPTIONAL)	Calculating the normalised scores for each pillar	**Facilitator or workshop organiser**
Step 7 (OPTIONAL)	Calculation of relative scores for each proposal	
Step 8	Final discussion and recommendations	**Whole group discussion**

Planning the groups

The number of attendees will determine how many small table discussion groups will be created. Aim to keep the size of each group under eight people. It's a good idea to allocate people to each table based on the following general rules:

- Have level of representation from State government, local government and non-government consistent across each group
- If an agency is represented by more than one person, allocate each to a different group
- Each group should be made up of individuals with a range of views (i.e. pro-conservation through to pro-development)
- Try to balance gender and age in each group.

As people arrive on the day, they should be directed to the table they've been allocated. A trained facilitator should be placed on each table to guide the discussion and record the decisions. The number of table groups will determine the number of facilitators needed.

Resources needed

The main facilitator will need a whiteboard (or similar) to record the whole group discussions.

The facilitator on each table will need a method for recording the deliberations — either a laptop or paper to capture the information.

What happens after the workshop

The workshop concludes with an explanation of the next steps, agreement about feedback to be provided to workshop participants, and an evaluation of the workshop by the participants.

The facilitator should develop a summary of the discussions during the day and the scoring results to be provided to the Steering Group overseeing the trail planning. It may also be provided to workshop participants.

Photo: © Common Ground Trails, Photographer Deon Baker

On the day — Introducing the workshop

The workshop should commence with the usual introductions and a description of the process for the session, including the agenda and time allocation for the session. The rules of engagement for the session should be discussed — there are some keys ones — and each facilitator will have their own set as well. The key ones are as follows:

- The workshop will only function and arrive at an outcome if there is cooperation and agreement between participants, and each person will need to acknowledge differences and be prepared to 'shift ground'
- Importantly, the outcomes of the workshop are to inform and support decision-making, not to make a definitive decision on trail options.

Decision-making agencies will have specific processes for any necessary approvals with different options available for public involvement or comment. Stakeholders will be able to participate in these as normal as well as contributing to the MCDA workshop.

A note of encouragement

Please note that initiating the MCDA process may appear daunting — particularly the calculations to generate scores for relevant values. Please persevere.

Photo: © Danielle Stone

Hypothetical Trail Proposal

In a desire to boost local tourism, it has been proposed to establish a walking trail along a scenic part of the WA coastline. There are two alternative trail routes proposed. Both versions of the trail start and finish at the same locations.

Proposal One has a slight inland path for part of the trail that follows an elevated ridgeline. The inland route follows an informal local trail, would require less clearing and provides elevated panoramic views and improved shade before descending to coastline. This route however would be costlier to construct due to the slopes.

Proposal Two is a coastal route that would require cutting through a local wetland with a Threatened Ecological Community (TEC) and the establishment of a boardwalk to protect some sensitive vegetation from trampling and allow for access during winter inundation. Proposal Two may potentially attract more users as it has an easier gradient, however there is some debate over this assertion as other trails with this level of difficulty are well-frequented in other areas.

There is a wide range of stakeholders including the local government which is responsible for the local beach and infrastructure nearby, including the carparks and facilities at proposed end and start points. Several State government agencies are involved because of the regulation of wetlands and TECs, and the tourism potential of the region.

Adjoining local businesses are interested in the potential for increased visitation and additional business opportunities. Several adjoining landholders are also interested but are concerned about the potential for walkers to 'stray' onto their land. A local "friends group" is highly active in caring for the wetland and other local environmental features.

Photo: © Common Ground Trails, Photographer Eerik Sandstrom

MCDA Step 1 — Determine the relevant values

This step is done by the whole group.

The hypothetical trail proposal example presented above is used to illustrate how each step is undertaken and what the scoring looks like as you work through each stage.

The MCDA process requires the identification of important environmental, social and economic 'values' associated with a specific area. Environmental, social and economic values are often referred to as the three pillars of sustainability. A generic list of values is provided (see Table 2). Groups can also identify local values based on specific features such as a locally historically significant landmark, existence of an iconic but not protected local species with high tourism value (e.g. kangaroos) or a local facility potentially impacted by changes (e.g. local surf club).

The entire group should review the list of values to determine which values are relevant and may be impacted by the proposal. Additional values can be added if there is agreement that a locally important value is missing; and any value that is irrelevant to this proposal can be removed. There should be group consensus on all values included.

There should be a range of environmental, social and economic values selected but there is no need to have an equal number of values under each pillar. The values should be added to your scoring table (see Table 3).

Based on the hypothetical trail proposal (see page C10), the following values were selected:

Environmental:
- Biodiversity
- Landscape and amenity
- Wetland.

Social:
- Aboriginal heritage
- Recreation.

Economic:
- Local employment
- Tourism
- Initial costs.

Table 2: List of generic values

(Source: Middle et al. 2017[2])

Value	Descriptor
Environment values	
Biodiversity	Includes richness of species present, presence of Threatened Ecological Communities (TECs), presence of known threatened species including habitats.
International values	Contains habitats, species etc. of international significance and recognised through a formal treaty or by a recognised conservation agency/organisation.
Landscape and visual amenity	Contains landscapes of high landscape amenity — including special features and views and viewscapes.
Wilderness	The area is rarely visited by humans, is in relatively pristine condition, and has large areas where human interference — noise or built structures — is not evident.
Wetland/Estuary	Site contains significant wetlands or estuaries.
Social values	
Educational value	Proposal has a range of features or is designed to be a significant educational resource. Proximity to educational institutions is also a factor.
Aboriginal heritage	Site contains significant Aboriginal sites or has other significant cultural significance.
Health and wellbeing	Capacity for the proposal to add to health and wellbeing of the population — number of potential users and length and difficulty of the proposal.
Nature interaction	Capacity for the proposal to encourage interaction between people and nature — number of potential users, ease of access, and diversity of vegetation, habitats and landscapes.
Wilderness interaction	Capacity to provide a wilderness experience — extent of existing wilderness and the capacity of the proposal to detract from that – number of potential users is a significant factor.
Recreation	Capacity for the proposal to add to or take away from existing recreation uses.
Local sense of place	Significance of existing local sense of place and capacity to add to or take away from that.
Economic values	
Basic raw materials (e.g. gravel)	Significance of existing resources and capacity to add to or take away from that.
Public water resources	Part of a public water supply catchment — consider impacts of proposal on that resource.
Tourism	Capacity of proposal to create tourism opportunities and revenue.
Pay per use	Capacity of proposal to generate fees from users.
Local employment	Capacity of proposal to create (or compete with existing) local employment.
Mining	Capacity of proposal to compete with existing or proposed mining activities — is it a threat to mining?
Management cost	How significant are the ongoing management costs likely to be?
Liability	Will the proposal create any potential financial liability for the proponent?
Initial costs	Likely initial establishment costs.

2. Middle, I. Hughes, M., Middle, G. and Ty, M. *Application of Multi-Criteria Decision Analysis for recreational trails decision making in Western Australia: Final technical report.* Centre for Sport and Recreation Research, Curtin University, Perth, April 2017

Photo: © WestCycle

MCDA Step 2 — Agree on the relative weightings of the three pillars

This step is done by the whole group.

As a whole, the group decides the relative importance for the three pillars — environmental, social and economic — and provides them with an appropriate weighting. The default position is that the group considers the three pillars as equally important. This does make later calculations easier.

For this hypothetical example, the group decided that the three pillars are all equally important and should be equally weighted.

If it is decided to have different weighting for each pillar, the total weighting must add to a total of 100. These relative weightings affect the calculations in MCDA Step 7 (OPTIONAL). An example could be:

- Environmental: 40
- Social: 30
- Economic: 30

MCDA Step 3 — Determine the weightings of individual values

This step is done by each small table group.

Each table should discuss the relative importance of the individual values within each pillar. Each value is then given a weighting using a scale of 1-3, with 3 being highly significant or important, and 1 being the least significant or important. There must be full agreement within the group on each weighting. The group may decide to give the same weighting to each value.

Record this information in the "**Weighting**" column in the table, as shown below. This table will also be used to record scores from Steps 5 and 6.

For this hypothetical example, it was decided to allocate different weightings to each specific value as shown in Table 3.

Table 3: Scoring Table Step 3

Value	Proposal 1			Proposal 2			Maximum Possible Score	Notes — explaining the scores
	Weighting (a)	Raw Score (b)	Weighted Score (a x b)	Weighting (a)	Raw Score (b)	Weighted Score (a x b)		
Environmental								
Biodiversity	3			3				
Landscape and amenity	2			2				
Wetland	2			2				
Totals								
Social								
Aboriginal heritage	3			3				
Recreation	2			2				
Totals								
Economic								
Local employment	3			3				
Tourism	2			2				
Initial costs	1			1				
Totals								

MCDA Step 4 — Create a scoring system for the individual values

This step is done by each small table group.

At each table, rate the likely impact of each proposal on each value. The scoring is subjective and is based on the expertise and experience of the participants at each table. Some discussion may be required to reach consensus on each value.

The scoring range is +5 to -5 to recognise both positive and negative impacts. The highest possible raw score is +5. A score of '0' indicates the proposal will not generate any identifiable positive or negative impact.

This score is entered in the "**Raw Score**" column in the table (Table 4). The last column is used to record notes explaining how scores or weightings were determined. It is really important to gather this information, as it will be useful to the Steering Group.

Table 4: Scoring Table Step 4

Value	Proposal 1			Proposal 2			Maximum Possible Score	Notes — explaining the scores
	Weighting (a)	Raw Score (b)	Weighted Score (a x b)	Weighting (a)	Raw Score (b)	Weighted Score (a x b)		
Environmental								
Biodiversity	3	0		3	-2			Proposal 2 passes through a Threatened Ecological Community (TEC).
Landscape and amenity	2	-2		2	-1			Both proposals will create a visible 'scar' on the landscape, with Proposal 1 having more impact.
Wetland	2	0		2	-3			Proposal 2 will have an impact on a significant wetland.
Totals								
Social								
Aboriginal heritage	3	0		3	-2			The TEC is also an Aboriginal cultural site. In Proposal 2, the trail goes close to this site which increases the risk of damage.
Recreation	2	3		2	4			Proposal 2 is likely to attract more visitors.
Totals								
Economic								
Local employment	3	2		3	3			Both proposals should bring more people to the area. Proposal 2 is likely to attract more visitors.
Tourism	2	3		2	4			Proposal 2 is likely to attract more visitors.
Initial costs	1	-2		1	-1			Proposal 1 is more complex to construct.
Totals								

MCDA Step 5 — Calculate the weighted scores for each value and pillar

The group or the facilitator can either do these calculations during a break

The next three steps require some calculations based on each group's scores.
There are two parts to Step 5:

1. Calculate the weighted scores for each value and each proposal by multiplying the **Weighting (a)** by the **Raw Score (b)**. This is a straightforward calculation — a x b. Enter these into the "WEIGHTED SCORE" column.
2. Add up the **Weighted Scores** for each pillar (environmental, social, economic) and enter the totals, as shown below.

Table 5: Scoring Table Step 5

Value	Proposal 1			Proposal 2			Maximum Possible Score	Notes — explaining the scores
	Weighting (a)	Raw Score (b)	Weighted Score (a x b)	Weighting (a)	Raw Score (b)	Weighted Score (a x b)		
Environmental								
Biodiversity	3	0	**0**	3	-2	**-6**		Proposal 2 passes through a Threatened Ecological Community (TEC).
Landscape and amenity	2	-2	**-4**	2	-1	**-2**		Both proposals will create a visible 'scar' on the landscape, with Proposal 1 having more impact.
Wetland	2	0	**0**	2	-3	**-6**		Proposal 2 will have an impact on a significant wetland.
Totals			**-4**			**-14**		
Social								
Aboriginal heritage	3	0	**0**	3	-2	**-6**		The TEC is also an Aboriginal cultural site. In Proposal 2, the trail goes close to this site which increases the risk of damage.
Recreation	2	3	**6**	2	4	**8**		Proposal 2 is likely to attract more visitors.
Totals			**6**			**2**		
Economic								
Local employment	3	2	**6**	3	3	**9**		Both proposals should bring more people to the area. Proposal 2 is likely to attract more visitors.
Tourism	2	3	**6**	2	4	**8**		Proposal 2 is likely to attract more visitors.
Initial costs	1	-2	**-2**	1	-1	**-1**		Proposal 1 is more complex to construct.
Totals			**10**			**16**		
Final Totals			**12**			**4**		

At this point in the process, there should be a decision whether to proceed to Steps 6 or move ahead to discussing the weighted scores shown in the Scoring Table.

There is relatively little advantage to the workshop in completing Steps 6 and 7 which create normalised scores for more accurate scoring in circumstances where:

- The three pillars are equally weighted
- There are roughly the same number of individual values within each pillar
- There is a substantial difference between the final total of proposals.

Tables 9 and 10 at Step 7 show the scoring completed for the hypothetical example completing the normalising for the individual scores as well as adjusted scoring based on pillars with differential ratings. As can be seen, the weighting process will adjust the overall scores but not enough to make a difference in the comparative differences between the **Final Totals**.

For groups where the scoring is very similar or where there are large differences between the number of individual values in each pillar, they should proceed to Step 6.

For groups that are not going to proceed with the additional calculations in Steps 6 and 7, they should undertake the group discussion as detailed below and then proceed to Step 8.

Each table group should reconvene to review their results and discuss and agree on the key points to present back to the full group about its deliberations.

In this example, Proposal 1 is potentially the preferred alternative as it has a total higher score than Proposal 2, has fewer environmental impacts than Proposal 2 and has a higher positive social impact than Proposal 2. However, Proposal 2 scores higher for economic values.

Discussion points for each small group

Each group should discuss and write down the following information for use in the final discussion at Step 8 and to provide to the facilitator for the final report:

- Which is the preferred alternative?
- Which values were most influential in deliberations (i.e. which were rated 3 in Step 3)?
- Looking at the rating of the impact on each proposal on values (at Step 4), which three values were likely to be impacted most positively (i.e. highest raw score) by Proposal 1 and by Proposal 2?
- In Step 4, which three values were likely to be impacted most negatively (i.e. lowest raw score) by Proposal 1 and by Proposal 2?
- Reviewing the explanatory notes (RH column at Step 4), please do two things:
  1. Add any extra explanatory notes that are needed to fully communicate the group's thinking
  2. Identify any simple changes that could be made to either proposal to reduce its negative impacts or increase its benefits.
- What additional consultation should be considered during the rest of the Trail Development Process?

At the conclusion of this discussion, proceed to Step 8.

Photo: © Chris Tate

MCDA Step 6 — Calculating the 'normalised' scores for each pillar for each proposal (OPTIONAL)

Calculations in Steps 6 to 7 are done by the table facilitator or workshop organiser. The group takes a break.

The calculations in this step are slightly more complicated.

In the hypothetical example, there are three values for both the environmental and economic pillars but only two social values. If we used only the weighted scores to calculate the total scores for each proposal, each pillar would not be equally weighted. To avoid this, each pillar score needs to be 'normalised'. This is done as follows:

1. Calculate the **Maximum Possible Score** for each value.
   - Do this by multiplying the weighting assigned to each value (figure a) by the highest possible raw score (+5)
   - Enter this figure into the column **Maximum Possible Score**.

   - The first value in the table is Biodiversity, which is weighted at 3
   - The highest possible raw score is 5
   - Multiply 3 x 5 = 15
   - This figure (15) is entered into the **Maximum Score Possible** column.

2. Tally the maximum possible score for each pillar and add this to the table.
   - In this example the **Total Maximum Possible Score** for the environmental pillar is 15 + 10 + 10 = 35.

The completed table (with maximum scores for social and economic values) is on following page.

Table 6: Scoring Table Step 6

(OPTIONAL)

Value	Proposal 1			Proposal 2			Maximum Possible Score	Notes — explaining the scores
	Weighting (a)	Raw Score (b)	Weighted Score (a x b)	Weighting (a)	Raw Score (b)	Weighted Score (a x b)		
Environmental								
Biodiversity	3	0	0	3	-2	-6	**15**	Proposal 2 passes through a Threatened Ecological Community (TEC).
Landscape and amenity	2	-2	-4	2	-1	-2	**10**	Both proposals will create a visible 'scar' on the landscape, with Proposal 1 having more impact.
Wetland	2	0	0	2	-3	-6	**10**	Proposal 2 will have an impact on a significant wetland.
Totals			-4			-14	**35**	
Social								
Aboriginal heritage	3	0	0	3	-2	-6	**15**	The TEC is also an Aboriginal cultural site. In Proposal 2, the trail goes close to this site which increases the risk of damage.
Recreation	2	3	6	2	4	8	**10**	Proposal 2 is likely to attract more visitors.
Totals			6			2	**25**	
Economic								
Local employment	3	2	6	3	3	9	**15**	Both proposals should bring more people to the area. Proposal 2 is likely to attract more visitors.
Tourism	2	3	6	2	4	8	**10**	Proposal 2 is likely to attract more visitors.
Initial costs	1	-2	-2	1	-1	-1	**5**	Proposal 1 is more complex to construct.
Totals			10			16	**30**	

In this example, the **Maximum Possible Score** is different for each pillar (environmental 35, social 25 and economic 30). This is because there is a different number of values in each category, as well as different weightings assigned to each value. However, in Step 3 the group determined that each of the three pillars has equal weighting.

To create this equal weighting, we need to do a calculation to 'normalise' the maximum possible total scores for each pillar, as follows:

3. Create a table like the one shown next. From the previous table, transfer across the information from these columns to Table 7:
   - Total maximum possible score for each pillar
   - Proposal 1 total weighted score for each pillar
   - Proposal 2 total weighted score for each pillar.

Normalising the scores when the pillars have equal weighting

4. Look at which of the maximum possible total scores of the three pillars is highest — in this case it is environmental (=35). This is the score against which the scores for the other two pillars need to be normalised.

5. Calculate a multiplier for the other two pillars to enable the lower possible scores (social = 25 and economic = 30) to be compared to the highest possible score (environmental = 35). Do this by dividing the highest maximum possible total pillar score by each pillar's maximum possible total score. In our example, the multipliers are:
   - Environmental pillar is 35/35 = 1
   - Social pillar is 35/25 = 1.4
   - Economic pillar is 35/30 = 1.17.

   Add the multipliers to the table.

6. For each pillar and each proposal, multiply the weighted score by the multiplier to calculate the normalised weighted scores. The end result of the calculations is shown in the table below.

Table 7: Normalised scores

Pillar	Total Maximum Possible Score	Multiplier	Proposal 1 Total Weighted Score	Proposal 1 Total Normalised Weighted Score	Proposal 2 Total Weighted Score	Proposal 2 Total Normalised Weighted Score
Environment	35	1	-4	-4	-14	-14
Social	25	1.4	6	8.4	2	2.8
Economic	30	1.17	10	11.7	16	18.72

Normalising the scores when the pillars have different weightings

Assume the pillars have different weightings: Environmental Pillar: 40; Social Pillar: 30; Economic Pillar: 30

7. Carry the Total Normalised Weighted Score from Table 7 for each proposal into a new table (Table 8), as shown below. The multiplier is calculated using the highest pillar weighting as the denominator (in this case 40), and the weighting for each pillar as the numerator.

8. For each pillar and each proposal, multiply the Total Normalised Weighted Score by the multiplier to calculate the Adjusted Normalised Weighted Scores. The end result of the calculations is shown in the table below.

Table 8: Normalised and weighted scores

		Proposal 1			Proposal 2		
Pillar	**Agreed value weighting**	**Total Normalised Weighted Score**	**Multiplier**	**Adjusted Total Weighted Score**	**Total Normalised Weighted Score**	**Multiplier**	**Adjusted Total Weighted Score**
Environment	40	-4	X 40/40	-4	-14	X 40/40	-14
Social	30	8.4	X 30/40	6.3	2.8	X 30/40	2.1
Economic	30	11.7	X 30/40	8.77	18.72	X 30/40	14.04

MCDA Step 7 — Final calculation of total combined scores for each proposal (OPTIONAL)

Calculations in steps 5 to 7 are done by the facilitator or workshop organiser.

From Step 6, for the pillars with the same weighting, add the three pillars' scores from Table 7 to get the total score for each proposal.

Table 9: Scoring comparisons — same pillar weightings

Pillars have the **same** weighting	Proposal 1		Proposal 2	
	Total Weighted Score	Total Normalised Weighted Score	Total Weighted Score	Total Normalised Weighted Score
Environment	-4	-4	-14	-14
Social	6	8.4	2	2.8
Economic	10	11.7	16	18.72
Total Combined Score	12	**16.1**	4	**7.52**

For pillars with the different weighting, transfer the scores from Step 6, Table 8.

Table 10: Scoring comparisons — different pillar weightings

Pillars have **different** weighting	Agreed value weighting	Proposal 1		Proposal 2	
		Total Normalised Weighted Score	Adjusted Total Weighted Score	Total Normalised Weighted Score	Adjusted Total Weighted Score
Environment	40	-4	-4	-14	-14
Social	30	8.4	6.3	2.8	2.1
Economic	30	11.7	8.77	18.72	14.04
Total Combined Score		16.1	**11.07**	7.52	**2.14**

The totals are then used to identify the preferred alternative based on the group's input.

In this example, Proposal 1 may be the preferred alternative as it scores higher using the simple calculation in Step 4 as well as the normalised and different pillar weighted calculations as shown in Tables 9 and 10 (if differential pillar scoring is used).

At this point, each table group reconvenes to review and confirm the results and discuss and agree on the key points to present back to the full group about its deliberations. These discussion points are the same as listed for Step 5. (See next page.)

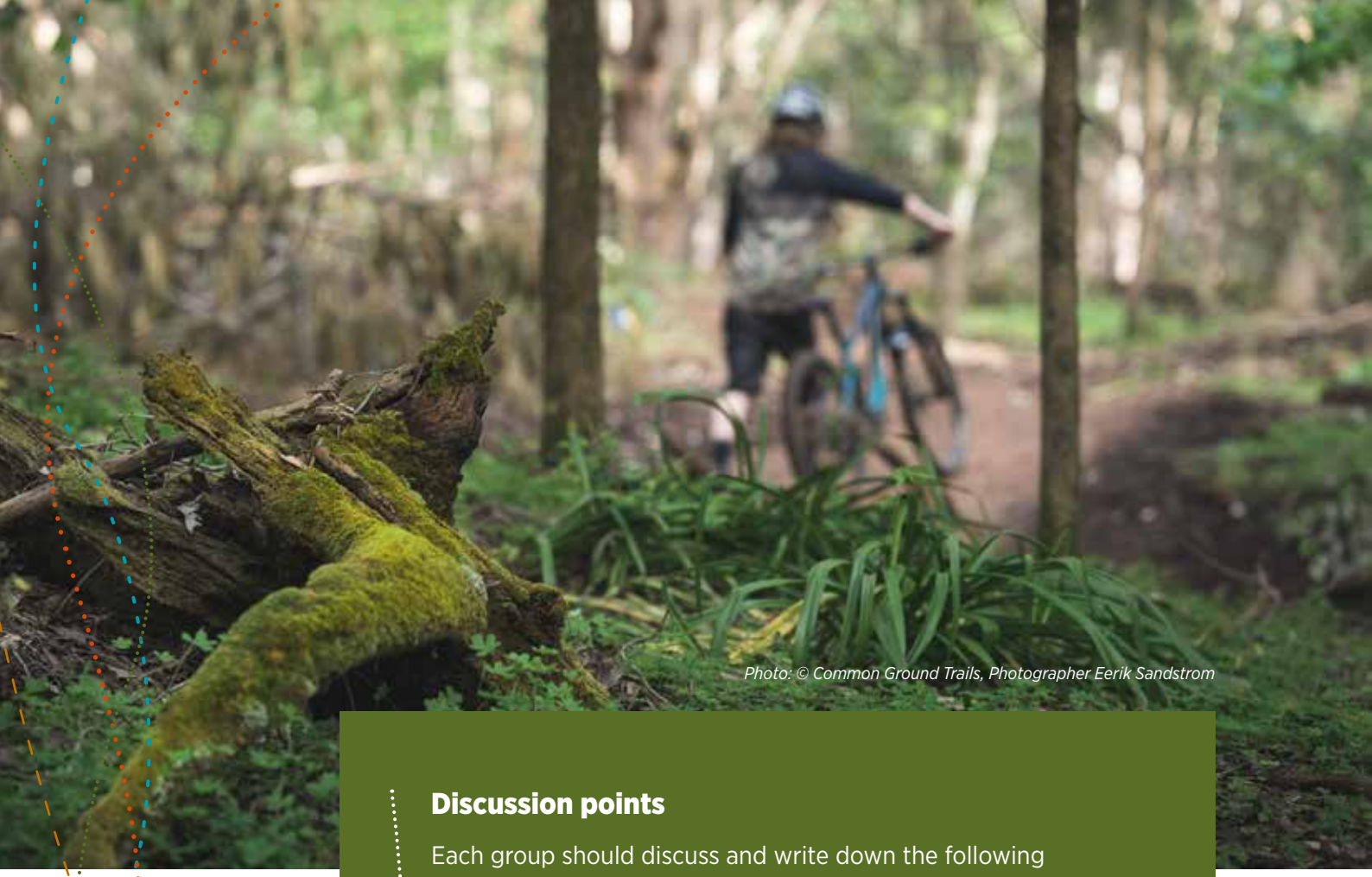

Photo: © Common Ground Trails, Photographer Eerik Sandstrom

Discussion points

Each group should discuss and write down the following information for use in the final discussion at Step 8 and to provide to the facilitator for the final report:

- Which is the preferred alternative?
- Which values were most influential in deliberations (i.e. which were rated 3 in Step 3)?
- Looking at the rating of the impact on each proposal on values (at Step 4), which three values were likely to be impacted most positively (i.e. highest raw score) by Proposal 1 and by Proposal 2?
- In Step 4, which three values were likely to be impacted most negatively (i.e. lowest raw score) by Proposal 1 and by Proposal 2?
- Reviewing the explanatory notes (RH column at Step 4), please do two things:
  - Add any extra explanatory notes that are needed to fully communicate the group's thinking
  - Identify any simple changes that could be made to either proposal to reduce its negative impacts or increase its benefits.
- What additional consultation should be considered during the rest of the Trail Development Process?

At the conclusion of this discussion, proceed to Step 8.

MCDA Step 8 — Final discussion and recommendations

The group comes together to discuss the final scores and make recommendations for further action.

The outcome of the process is to identify recommendations to inform the Trail Development Process. In this example, there are two proposals and the aim of the workshop is to identify the preferred option.

At this point, the overall workshop is reconvened, and each table group presents its results (as determined at the end of Step 5 or Step 7). The preferred alternative could be captured on the whiteboard as a simple tally:

Table #	Proposal 1 scores higher	Proposal 2 scores higher
1	•	
2	•	
3	•	
4		•
5		•
6	•	
7	•	

In this hypothetical tally above, there is a clear preference for Proposal 1. However, it is not unanimous, and the discussion needs to draw out the information each group has prepared.

Further, this discussion needs to be documented as part of the package of outcomes and recommendations to inform Trail Development Process Stage 6: Detailed Design.

Discussion points to be covered by the entire group include:

- Which values were most influential in deliberations (i.e. which were rated 3 in Step 3)?
  - Is there consistency about important values between the groups? If so, this is helpful for the Steering Group.
- Which three values were likely to be impacted most positively (i.e. highest raw score at Step 4) by Proposal 1 and by Proposal 2?
- Which three values were likely to be impacted most negatively (i.e. lowest raw score) by Proposal 1 and by Proposal 2?
- What simple changes could be made to either proposal to reduce its negative impacts or increase its benefits?
- What additional consultation should be considered during the rest of the Trail Development Process and who needs to be involved?

A number of these points will already have been discussed by the individual groups to prepare for this discussion.

Using the example notes recorded in the scoring tables, Proposal 2 in the case study scored very poorly on both biodiversity and Aboriginal heritage, primarily because the trail passes through a TEC and wetland, which is also a known Aboriginal cultural site and has significant local social importance. An amendment to Proposal 2 to move this section of the trail so it is further away from the TEC would help address this issue. Indeed, if this change was made prior to the MCDA methodology being applied, the scores given to Proposal 2 may have changed significantly.

While it is helpful to get a consensus on preferences, the value of the MCDA process is in these areas:

- Apart from needing consensus at Steps 1 and 2 to ground the process, it does not need a consensus solution
- Part of the value of MCDA as a process is that it accommodates diversity of viewpoints
- The diversity of viewpoints is all important information for the Steering Group to progress the Trail Development Process to reach a planning decision and detailed design
- The compilation of viewpoints expressed, together with the scores given to the individual values, and the notes that each group has made, can help in the final design and route selection of the trail option chosen.

Photo: © Common Ground Trails, Photographer Eerik Sandstrom

Notes

Photo: © Common Ground Trails, Photographer Eerik Sandstrom

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

Department of **Local Government, Sport and Cultural Industries**

ISBN: 978-1-921648-60-1