Platte River
Structured Decision Making

Platte River Recovery Implementation Program

Denver, Colorado

December 2, 2015

compass

Agenda

8:30 Introduction and Review of Agenda/Process
9:00 Decision Context and Objectives
10:30 Break
11:00 Performance Measures
12:00 Lunch
1:00 Alternatives and Consequences
2:30 Break
3:00 Synthesis and Next Steps
4:30 Close

Outcomes

- Build common understanding of the SDM process
- Get GC input on
  - decision context and bounds
  - decision objectives
  - performance measures
  - the range of alternatives that are in scope
- Confirm work plan and next steps

Housekeeping

- Breaks and food
- Washrooms and exits
- Closing time
- Pre-reading
- Meeting notes
- Speaking protocol

Meeting Ground Rules

- Come prepared
- Treat others with courtesy and respect
- Provide concise and relevant input on agenda items
- Consider the input of others
- Let differences stand
- Focus on solutions, be forward-looking
- Respect confidentiality

Use the parking lot

Introduction

Why are we here….

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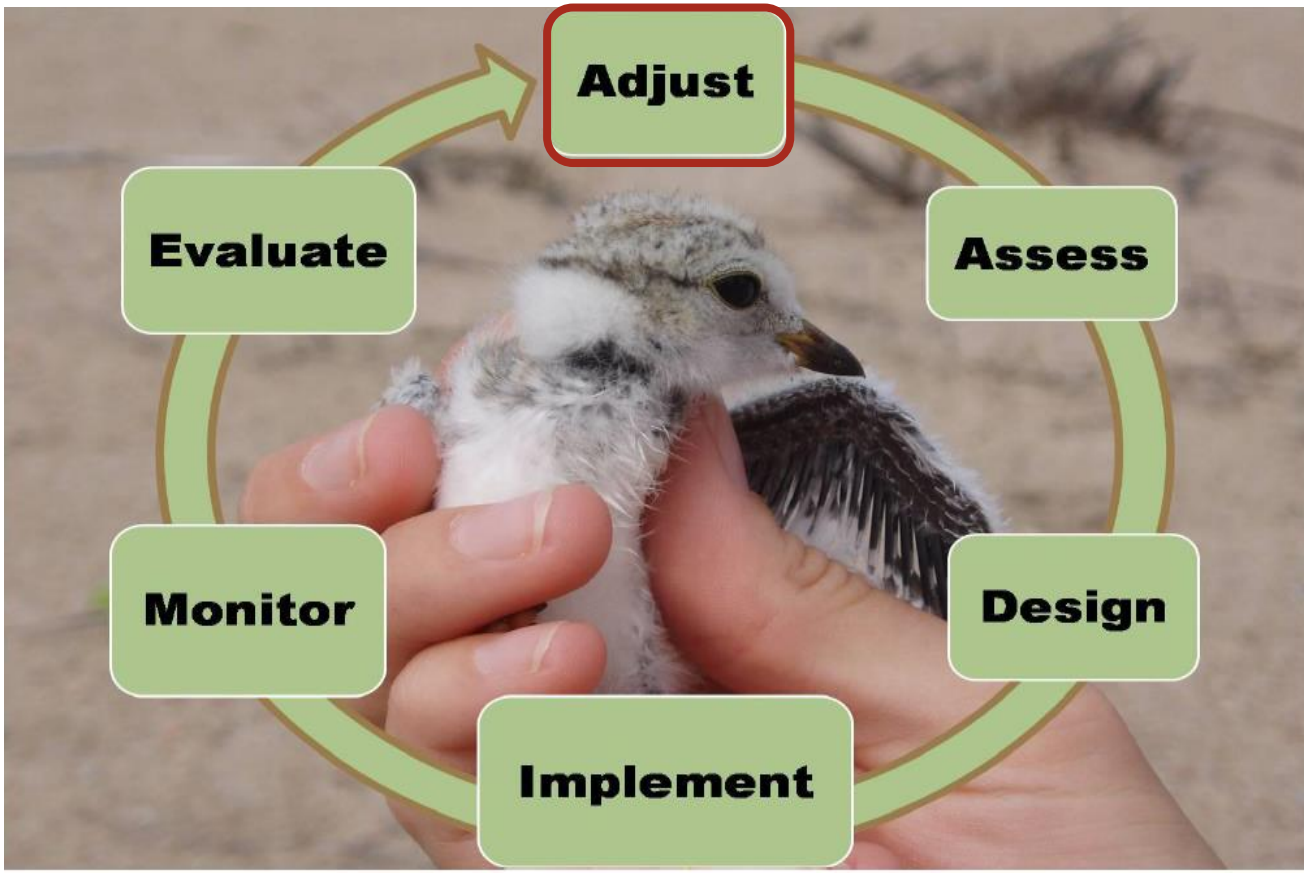
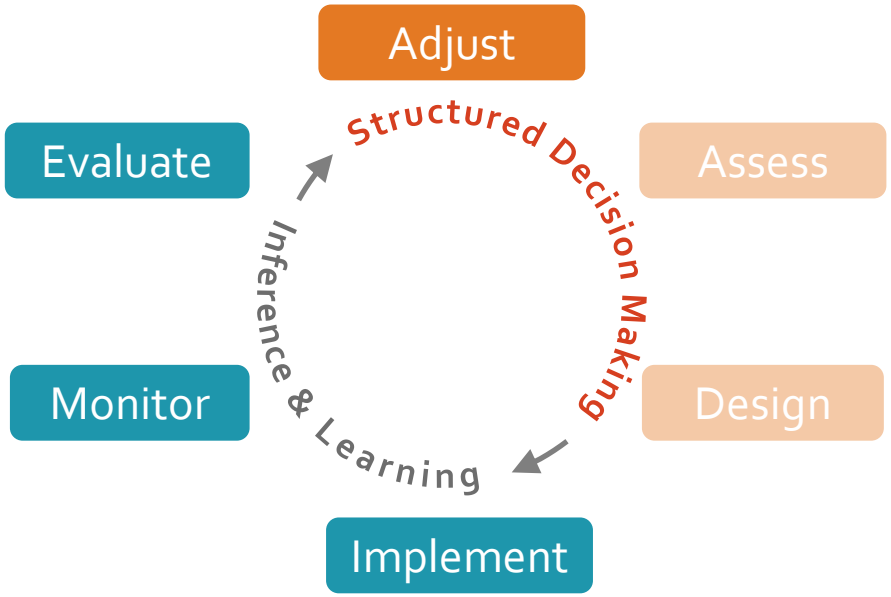
Why SDM?

How do we "adjust" to new information?



AM and SDM

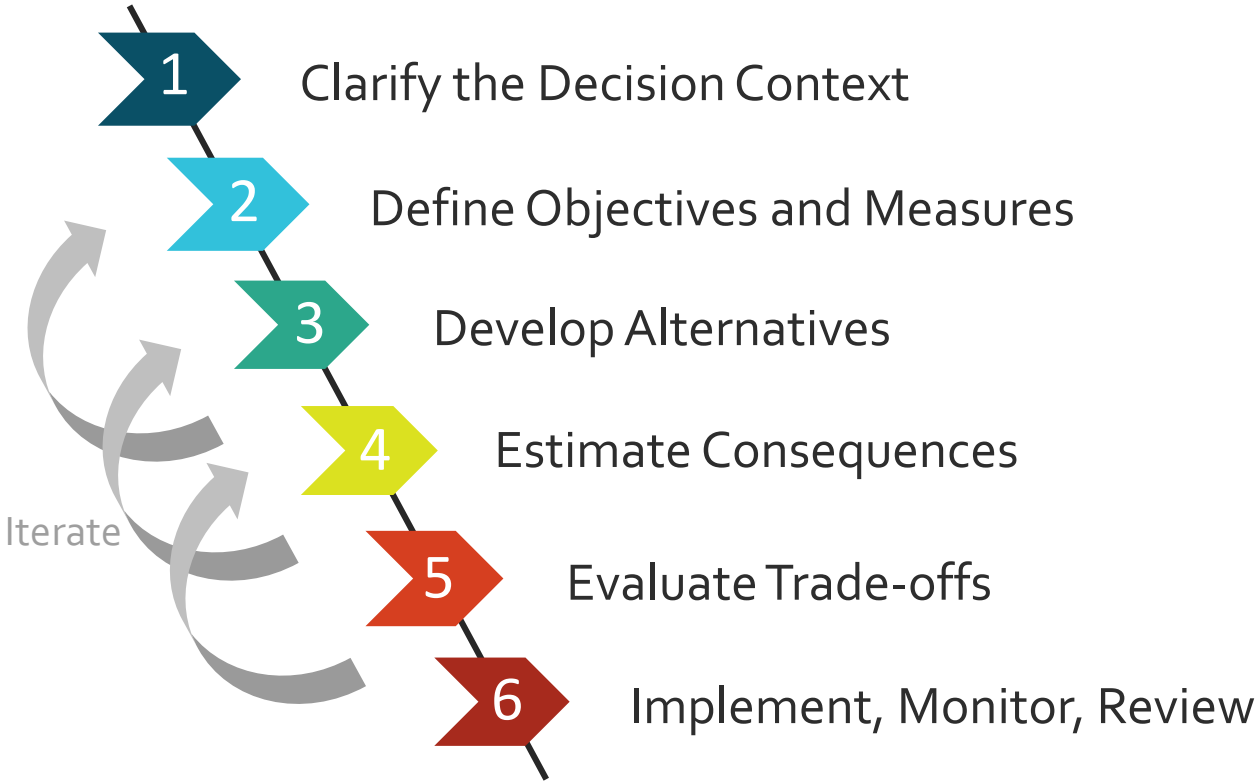
- **AM** emphasizes learning to improve the quality of information and inform management decisions
- **SDM** emphasizes making decisions based on best available information



Steps of SDM

"Decision analysis is formal use of common sense for problems that are too complicated for informal use"

Ralph Keeney



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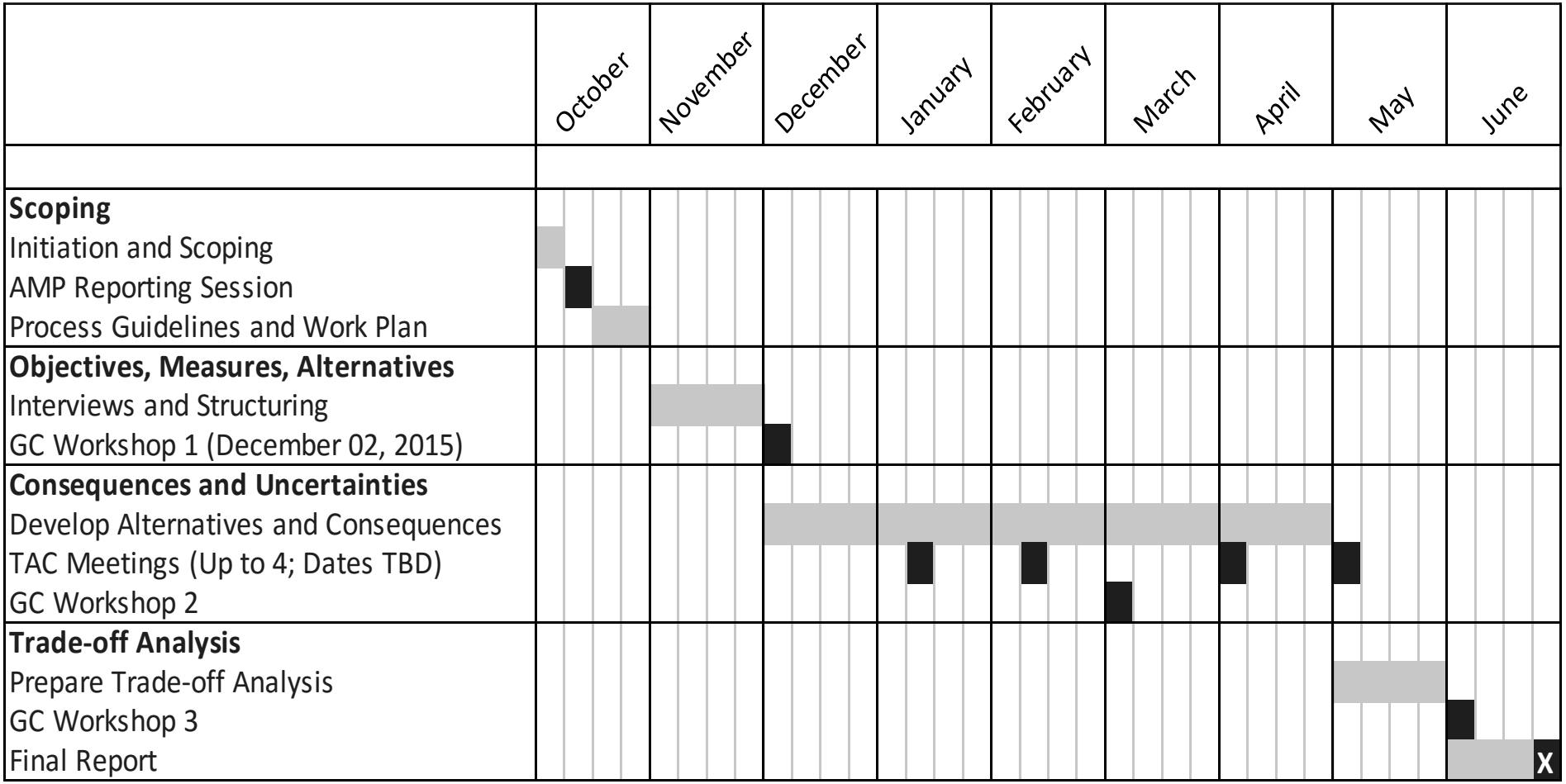
SDM Work Plan



Roles – from the Process G/Lines

- **GC members** will be responsible for ultimately making decisions about preferred alternatives
- **TAC members** will provide technical input to support the evaluation of alternatives and to inform GC members
- **ISAC** may be asked to review various technical analyses and/or invited to observe at some meetings
- **Other subject matter experts** may be consulted as required to provide input on technical methods or judgments for estimating consequences
- **EDO** will provide overall coordination of the SDM work plan and provide technical expertise to structure and populate the consequence table
- **Compass** will design and facilitate the SDM process including developing the overall work plan, structuring the decision, and facilitating the process

Roles - Continuity

- Continuity is important
  - Plan for fixed membership of both GC and the TAC for the duration of the process
  - In the event that a member is not able to attend, s/he is responsible for designating a formal alternate
  - Ensure the alternate is fully up to date and accepts past decisions

Decision Context

Session objectives:
Share key messages from interviews
Confirm direction from GC on scope – what's in and what's out?

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Interview summary

Should we use water to build nesting habitat for terns and plovers?

- No. There is agreement that it's not possible to do a water release capable of producing tern/plover sandbar nesting habitat within the existing water budget.

If more water were available, should it be used to build nesting habitat for terns and plovers?

- Maybe. But that is a Second Increment question.

Interview Summary

Are there other ways to use water to support terns and plovers?

- Maybe. The process should consider non-SDHF flow release options (e.g., nest initiation, moating, etc.).
- But there may be better uses for water; there is a need for a broader decision process at some point to more fully evaluate the benefits of different uses
- This process should at least consider opportunity cost of using resources for terns and plovers

Interview Summary

Need to evaluate options for on-channel nesting habitat for terns and plovers. When co-benefits are considered, these options may be worthwhile.

Off channel - how much is enough? At some point we will need to address this question.

There are important interactions among the Big Questions. There's a common interest in constraining this decision process to something practical that the GC can accomplish in the next few months. But its impossible to fully separate the Big Questions.

Decision Context

The decision:

- Given the two-thumbs-down assessment for Big Question #1, what's the best combination of management actions to take, for the remainder of the First Increment (assumed to be 2016 to 2019), for the purpose of maintaining or enhancing habitat for interior least terns and piping plovers?

Decision Context

- The focus is on actions for terns and plovers, but implications for other objectives will be evaluated
- Alternatives will include off-channel habitat, on-channel habitat, or a combination of both
- Alternatives will include mechanical actions, flow actions or a combination of both
- No alternatives related to using sediment augmentation for TP habitat have been proposed
- Alternatives will be feasible within existing budgets
- The decision is for the remainder of the First Increment (2016-19)
- There are a range of actions that the Program will be doing anyway that will not be affected by this decision

Decision Context

Questions that this SDM process *will* answer:

- What is the preferred combination of on- and off-channel management actions for terns and plovers for the remainder of the first increment?

Questions this SDM process will *not* answer:

- **What's the best use of Program resources?** The process as scoped can provide a general understanding of opportunity cost (financial and water), but will not compare the *benefits* of using water and money across all competing uses.
- **How much is enough?** The process will produce what the GC thinks is enough for the remainder of the First Increment. But it won't try to produce a final answer.

Objectives

Session Objectives:
Share Process Objectives
Share key considerations in selecting Decision Objectives
Get direction from GC on Decision Objectives to guide TAC next steps

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Different kinds of objectives

- **Process Objectives**
  - Objectives that guide how the decision is made rather than what management actions are selected
- **Decision Objectives**
  - Objectives that will be used to evaluate and compare management actions

Platte SDM Process Objectives

- Build common understanding about Program findings to date
- Ensure transparency, both in value trade-offs and in the assessment of consequences
- Ensure scientific rigor
- Use a level of analysis that's "good enough"
- Demonstrate ability of the AMP to help the Program adjust to new information
- Demonstrate progress to stakeholders/observers

Decision objectives

- **Decision Objectives** are concise statements of the outcomes that matter and could be affected by the decision.
- Keep it simple. You need a “thing that matters” and a direction:
  - (Minimize) **Management Cost**
  - (Maximize) **Bull Trout Abundance**
  - (Minimize) **Greenhouse Gases**
- They’re used to **identify and evaluate** alternatives

What's a good set of objectives?

- **Complete -** All of the important consequences are covered
- **Concise -** The number of objectives is the minimum appropriate for quality analysis and there are no overlapping / redundant concerns
- **Sensitive -** They are sensitive to the alternatives under consideration given the decision context and bounds
- **Specific -** The consequences of concern are clear enough that PMs can be readily defined
- **Understandable -** Any interested individual knows what is meant by it

Pitfalls in Setting Objectives

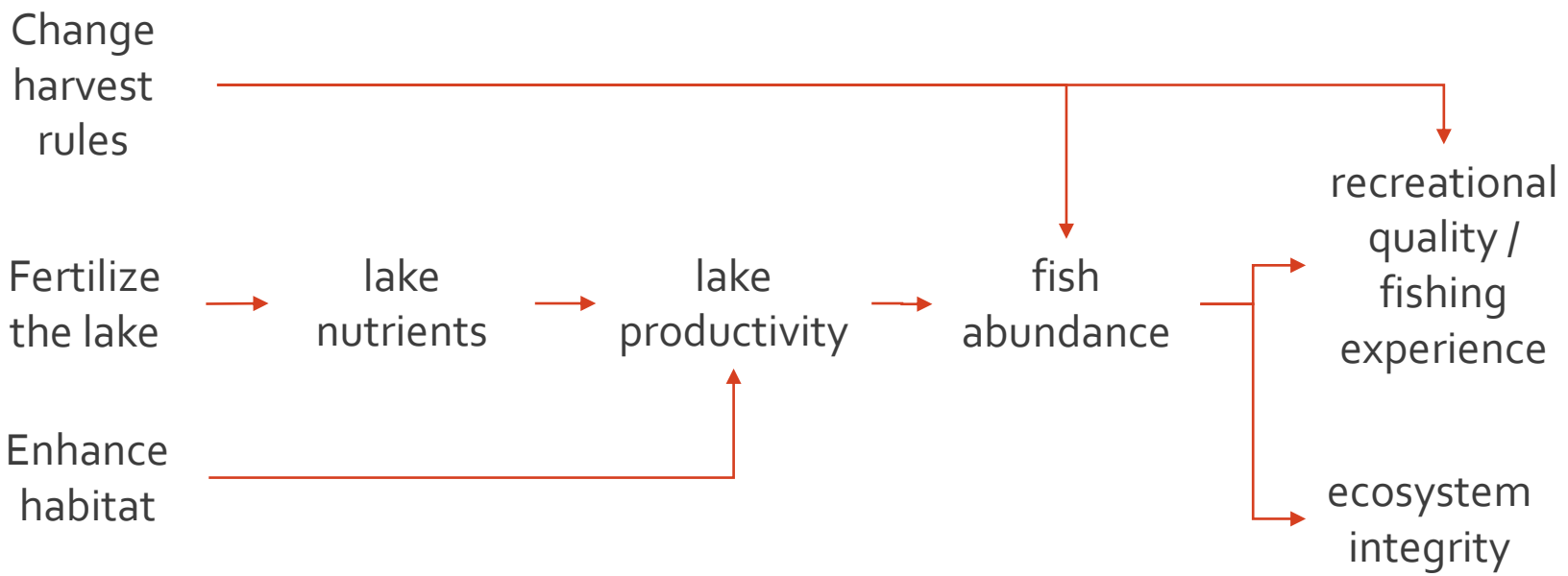
- Weighting or prioritizing them
- Setting targets
- Being unclear about preferred direction of change
- Including too many objectives
- Choosing vague or irrelevant objectives
- Mixing means and ends

Decision Objectives

Some Terminology:

- **Fundamental** objectives are the outcomes or **ends** you really care about, no matter how they are achieved
- **Means** objectives refer to particular ways of meeting the fundamental objectives

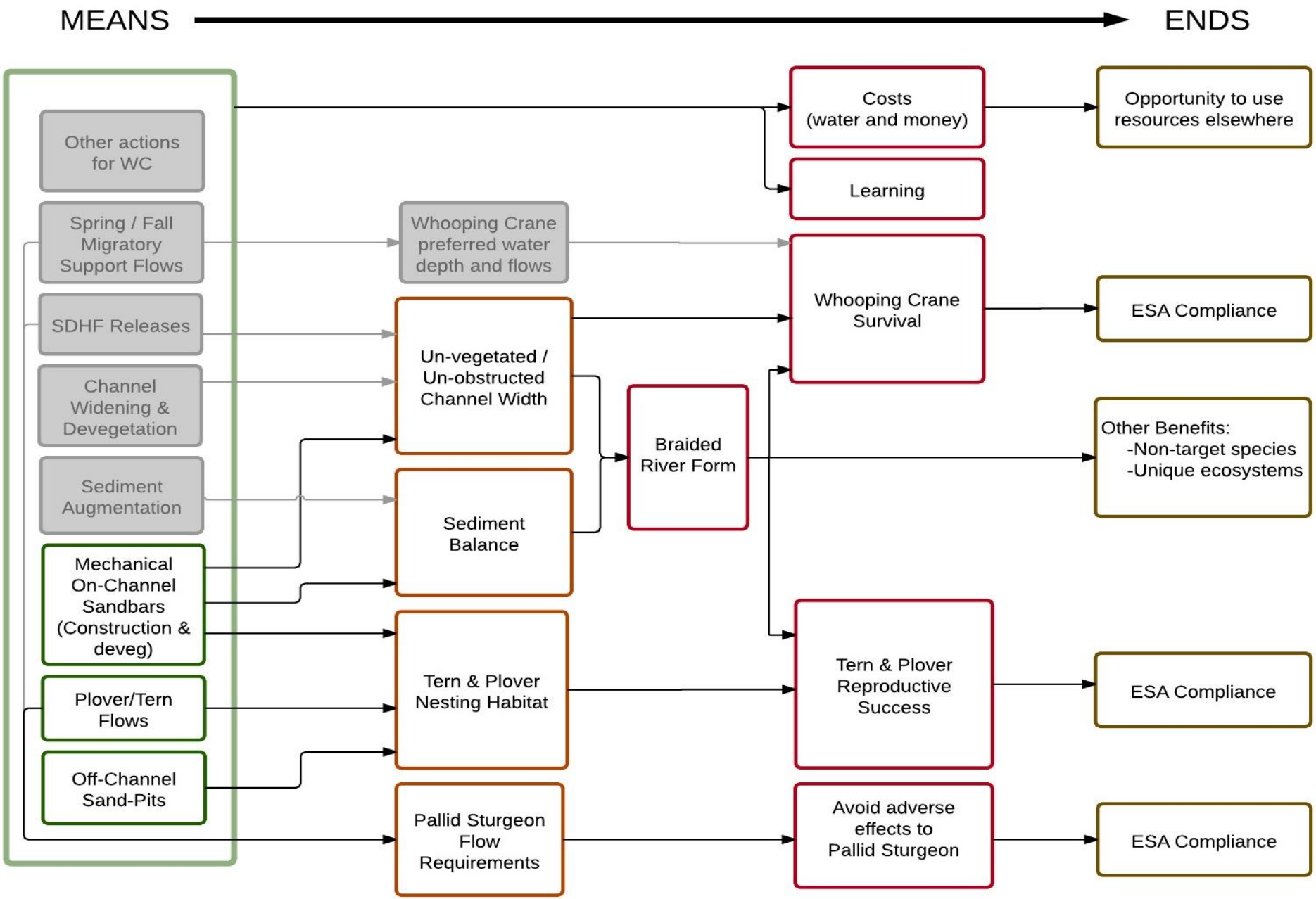
Means and Ends



How to get to objectives

- **Brainstorm** “what matters” and could be affected by the decision
- **Organize.** Separate means and ends, separate decision objectives from process objectives, be comprehensive but concise.
- **Test.** Are they helpful in comparing alternatives?

Platte SDM


MEANS
ENDS
Other actions for WC
Spring / Fall Migratory Support Flows
SDHF Releases
Channel Widening & Devegetation
Sediment Augmentation
Mechanical On-Channel Sandbars (Construction & deveg)
Plover/Tern Flows
Off-Channel Sand-Pits
Whooping Crane preferred water depth and flows
Un-vegetated / Un-obstructed Channel Width
Sediment Balance
Tern & Plover Nesting Habitat
Pallid Sturgeon Flow Requirements
Braided River Form
Costs (water and money)
Learning
Whooping Crane Survival
Tern & Plover Reproductive Success
Avoid adverse effects to Pallid Sturgeon
Opportunity to use resources elsewhere
ESA Compliance
Other Benefits:
-Non-target species
-Unique ecosystems
ESA Compliance
ESA Compliance

Decision Objectives Straw Dog

- Tern Reproductive Success
- Plover Reproductive Success
- Co-benefits for Whooping Cranes
- Co-benefits for Braided River Form
- Adverse Effects on Pallid Sturgeon
- Management Costs
- Learning?

Clarify and Test Them

Do they help distinguish among alternatives?

Objective	Dir				
Tern Reproductive Success					
Average Fledging Success	H	-	-	-	-
Number of Fledglings	H	-	-	-	-
Plover Reproductive Success					
Average Fledging Success	H	-	-	-	-
Number of Fledglings	H	-	-	-	-
Co-Benefits for Whooping Crane					
Survival During Migration	H	-	-	-	-
Braided River Form					
Sediment Balance	H	-	-	-	-
Unvegetated Channel Width	H	-	-	-	-
Management Cost					
Financial Cost	L	-	-	-	-
Water Cost	L	-	-	-	-
Adverse Effects on Pallid Sturgeon					
Adverse Flow Conditions	L	-	-	-	-
Learning					
Terns	H	-	-	-	-
Plovers	H	-	-	-	-
Mechanisms for maintaining Braided River	H	-	-	-	-

Candidate Performance Measures

Session Objectives:

Share key considerations in selecting PMs

Get high-level input from GC on draft candidate PMs

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What's a performance measure?

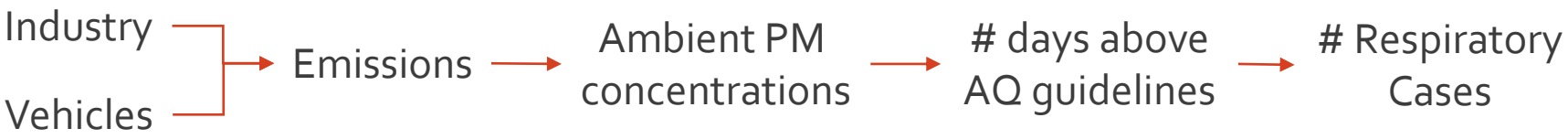
- A specific metric for describing the performance of the alternatives with respect to a decision objective
- Defining PMs determines how you will estimate consequences

Also known as:

- attributes, indicators, criteria

Natural and Proxy Measures

Objective	Natural	Proxy
Boreal caribou	**Abundance** (# in 2030)	**Area of critical habitat** (acres)
Health	**Respiratory cases** (cumulative # to 2030)	**PM Concentrations** (# days per year above health guideline)



Three Kinds of Measures

Objective	Natural	Proxy	Constructed Scale
Boreal caribou	**Abundance** (# in 2030)	**Area of critical habitat** (acres)	**Scale of 1-5,** where 1 = < critical pop 5 = > stable pop
Health	**Respiratory cases** (cumulative # to 2030)	**PM Concentrations** (# days per year above health guideline)	**Scale of 1-5,** where 1 = 20% increase in cases 5 = 20% reduction in cases

What is a good PM?

- **Accurate and direct**– there is a clear and well-accepted relationship between the PM and the objective
- **Unambiguous** – it is clearly defined, suitably precise, and will be interpreted by everyone the same way
- **Understandable** – consequences and value trade-offs made using the PM can be readily understood and communicated
- **Operational** – information and tools needed to model and report it are or can be made available
- **Complete and concise –** as a set, the PMs report all the essential consequences without duplication

Choosing the best PM…

- Is complicated!
- There are trade-offs
  - Between complete and concise
  - Between accurate and understandable
  - Between accurate and operational
- There are no ”right” PMs, but some are more useful than others

More on PMs

The choice of PM embeds:

- Technical judgments – about which PM most accurately represents effects on the objective
- Value judgments – about what exactly is the thing that matters

- Role of the GC (values)
- Role of the TAC (facts)

Candidate PMs

Objective	Sub-objective	Candidate PM
Terns/Plovers	Maximize average fledgling success rate	Average # fledglings per nesting pair across all AHR nesting areas
		Average # fledglings per acre of habitat
	Maximize total number of fledglings	Expected total # fledglings over x years produced in the AHR
Cost	Financial Cost	$, levelized over x years
	Water Cost	Acre-feet of water per year
Co-benefits for WC	WC survival during migration	Average unobstructed sight line distance (m) in key stopover areas
		Km of channel that exceed the minimum unobstructed channel width
		Constructed Scale, where 1 = strongly negative, 5 = strongly positive

Candidate PMs

Objective	Sub-objective	Candidate PM
Braided River Form	Maximize sediment balance	Proportion of river length in habitat complexes that is not supply limited.
		Volume of sediment released
		Constructed scale, where: 1 = area downstream of Kearney in balance, 5 = entire AHR in balance
	Maximize unvegetated channel width	Average width (m) of unvegetated channel in habitat complexes
Pallid Sturgeon	Minimize adverse flow conditions	Binary (Yes/No)
Learning?	Maximize ability to answer BQs	Constructed scale, where: 1 = unlikely to provide insight into other BQs 5 = likely supports ability to discriminate between competing hypotheses

Choosing PMs

- Accurate and direct
- Unambiguous
- Understandable
- Operational
- Complete and concise

The TAC will use these criteria for establishing PMs over the course of the winter and spring

Consequence Table

Objective	Performance Measure	Units	Dir				
Tern Reproductive Success							
Average Fledging Success	fledge ratio	ratio	H	-	-	-	-
Number of Fledglings	fledges over 3 yrs	#	H	-	-	-	-
Plover Reproductive Success							
Average Fledging Success	fledge ratio	ratio	H	-	-	-	-
Number of Fledglings	fledges over 3 yrs	#	H	-	-	-	-
Co-Benefits for Whooping Crane							
Survival During Migration	Index	scale (1-5)	H	-	-	-	-
Braided River Form							
Sediment Balance	% of river not supply limited	%	H	-	-	-	-
Unvegetated Channel Width	avg. unvegetated width	m	H	-	-	-	-
Management Cost							
Financial Cost	levelized cost per year	$	L	-	-	-	-
Water Cost	water volume per year	acre-feet	L	-	-	-	-
Adverse Effects on Pallid Sturgeon							
Adverse Flow Conditions	Yes/No Flag	binary	L	-	-	-	-
Learning							
Terns	Index	scale (1-5)	H	-	-	-	-
Plovers	Index	scale (1-5)	H	-	-	-	-
Mechanisms for maintaining Braided River	Index	scale (1-5)	H	-	-	-	-

Alternatives

Session Objectives:
Share key considerations in developing alternatives
Get high-level input from GC on draft preliminary alternatives

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Alternatives

- **An alternative is….**a complete, internally coherent and distinct response to a problem that can be directly compared with other responses by decision makers.
- **The goal is learning** …. proposing an alternative means you propose that it's worth examining; it doesn't mean you support it or that it's your preferred alternative

Alternatives – Why?

- Learn and build common understanding
  - Explore novel ideas and competing hypotheses
- Eliminate unnecessary trade-offs
  - By iteratively improving alternatives
- Get ready to make trade-offs
  - People only make hard trade-offs if they believe all reasonable alternatives have been explored
  - What is “acceptable” depends on the alternatives

Alternatives – The Basics

- **Generate** alternatives that address the decision objectives (value-focused thinking)
- **Organize them.** Are there many actions that need to be combined into logical categories? What are the categories of actions?
- **Iteratively refine them.** Start with “bookends” or basic ones that let you learn. Look at the trade-offs and try to reduce them

Pitfalls in Generating Alternatives

- Anchoring
- The Goldilocks effect
- Under-prescribing
- Comparing apples and oranges
- Failing to define the base case
- Considering sunk costs

First-Cut Platte SDM Alternatives

- Stay the course
- Off-channel actions only
- On-channel actions only
- Combination

Prescribing Complete Alternatives

- Each alternative needs to be fully specified:
  - At what location
  - At what level of intensity or investment
  - Over what period of time
  - Using what methods
- Consider a tiered evaluation
  - Initial screening evaluation
  - Detailed evaluation
- Alternatives need to respect constraints
  - Upper limits

Stay the Course -what's included?

On channel TP Habitat	Continue to build 42 acres per year at permitted habitat complexes using existing methods.
Off Channel TP Habitat	Continue to maintain 87 acres of Program habitat. Assume 48 acres of NPPD owned habitat is maintained. Includes spraying and predator fences and trapping.
Channel Widening	Continue efforts at same rate described in 2016 PRRIP Work plan. Methods include tree clearing, channel disking, herbicides.
Sediment Augmentation	Continue with mechanical placement and augmentation of 60-80,000 tones/year at Plum Creek complex.
Acquiring Water	Continue with Water Action Plan per 2016 PRRIP Work Plan, including $43 million for the J2 Reservoir and $9 million per year on average for other actions to reduce shortages to target flows.
Monitoring and Research	Continue with monitoring and research activities according to the AMP to inform BQ's #1-11.
Budget	The EDO estimates an unallocated PRRIP budget of amount of $8-9 million for 2016-2019 under Stay the Course as defined.

Upper limits
What's possible for other alternatives?

On-channel Area:

- ~ 100 acres possible
  - 42 permitted acres
  - ~68 un-permitted acres

Off-channel Area:

- No real upper limit, but
  - ~110 possible acres of old and active mine sites
  - No land-based constraints for other off-channel habitat.

Budget constraints:

- ~ $8M over the rest of the First Increment (2016-2019)
- *130-150,000 af/yr*

Prescribing a complete alternative

Often, **a complete alternative is** best described by **a set of** logically complementary **actions**.

E.g., flow management actions wouldn't be included in an alternative focused off-channel.

Habitat		Flow Management Actions	
Area of Off-Channel Habitat (Acres)	Area of On-Channel Habitat (acres)	Nest Initiation Flows (cfs)	Moating Flows (cfs)
0	0	None	None
20	10	200	200
40	20	800	800
60	30	1200	1200
80	40		
100	50		
120	60		
140	70		
160			

Prescribing a complete alternative

But an on-channel alternative *could* include flow management actions to increase its performance.

Habitat		Flow Management Actions	
Area of Off-Channel Habitat (Acres)	Area of On-Channel Habitat (acres)	Nest Initiation Flows (cfs)	Moating Flows (cfs)
0	0	None	None
20	10	200	200
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160			

Prescribing a complete alternative

Habitat		Flow Management Actions	
Area of Off-Channel Habitat (Acres)	Area of On-Channel Habitat (acres)	Nest Initiation Flows (cfs)	Moating Flows (cfs)
0	0	None	None
20	10	200	200
40	20	800	800
60	30	1200	1200
80	40		
100	50		
120	60		
140	70		
160			

vs.

Habitat		Flow Management Actions	
Area of Off-Channel Habitat (Acres)	Area of On-Channel Habitat (acres)	Nest Initiation Flows (cfs)	Moating Flows (cfs)
0	0	None	None
20	10	200	200
40	20	800	800
60	30	1200	1200
80	40		
100	50		
120	60		
140	70		
160			

On channel nesting habitat ideas

- **Build and maintain big, permanent sandbars** (mechanical). Where available, these sandbars are created by buying vegetated sandbars and de-vegetating them. Once de-vegetated, sandbars erode. Continual maintenance required.
- **Build small, shifting groups of sandbars.** Sandbars erode over time and are re-built in different locations. Thought to be more cost-effective than building/maintaining permanent bars and may help prevent predator traps.
- **Extend the life of naturally formed sandbars.** In high flow years, sandbars are formed at a range of heights. Sandbars above the minimum height for nesting would be maintained in a de-vegetated state to extend the length of time available for nesting. Bars just below the minimum height could be used as a base for the construction of higher sandbars.
- **De-vegetate sandbars and allow them to erode**. Most of these sandbars are owned privately and would have to be bought or brought under negotiated management agreements. There may be potential short-term co-benefits for WCs (increased unvegetated channel width) and sediment balance (release of sediment trapped in vegetated sandbar).

On-channel Flow Ideas

- **Maintain a "nest initiation flow**". Program data suggest that increasing discharge during the nest initiation period increases on-channel habitat utilization under low flow conditions.
- **Maintain a "moating flow".** The intent would be to separate sandbars from the mainland during incubation and rearing. It is hypothesized by some that providing a moating flow reduces predation from terrestrial predators. Thus far, the Adaptive Management Plan has not tested this hypothesis.

Off-channel nesting habitat ideas

- **Maintain current off-channel habitat.** The Program is currently managing 135 acres of off-channel nesting habitat, which includes a combination of rehabilitated sandpits, mined sandpits, and mechanically created sandpits.
- **Acquire new off-channel habitat at mining sites.** Acquire and/or negotiate agreement with mine operators to conduct mining operations in such a way as to create tern and plover nesting habitat. This approach is typically quite inexpensive but very slow. It often takes operations a decade or more to mine out an entire site.
- **Acquire and restore off-channel sandpit habitat.** Acquire existing abandoned mine sites and rehabilitate suitable nesting habitat through vegetation removal and modification of existing spoil areas. This approach is quick and typically inexpensive but there are a limited number of existing abandoned mine sites.
- **Construct new-off channel sandpit habitat**. Acquire lands adjacent to the channel or in the floodplain and construct nesting habitat through mass grading operations. This approach is typically quite expensive but habitat can be constructed quickly.

Consequences

Session Objectives:

Share general approach to estimating consequences

Get high-level input from GC on the approach

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Consequence Table

Objective	Performance Measure	Units	Dir	Stay the Course	All On-Channel	All Off-Channel	Combination
Tern Reproductive Success							
Average Fledging Success	fledge ratio	ratio	H	-	-	-	-
Number of Fledglings	fledges over 3 yrs	#	H	-	-	-	-
Plover Reproductive Success							
Average Fledging Success	fledge ratio	ratio	H	-	-	-	-
Number of Fledglings	fledges over 3 yrs	#	H	-	-	-	-
Co-Benefits for Whooping Crane							
Survival During Migration	Index	scale (1-5)	H	-	-	-	-
Braided River Form							
Sediment Balance	% of river not supply limited	%	H	-	-	-	-
Unvegetated Channel Width	avg. unvegetated width	m	H	-	-	-	-
Management Cost							
Financial Cost	levelized cost per year	$	L	-	-	-	-
Water Cost	water volume per year	acre-feet	L	-	-	-	-
Adverse Effects on Pallid Sturgeon							
Adverse Flow Conditions	Yes/No Flag	binary	L	-	-	-	-
Learning							
Terns	Index	scale (1-5)	H	-	-	-	-
Plovers	Index	scale (1-5)	H	-	-	-	-
Mechanisms for maintaining Braided River	Index	scale (1-5)	H	-	-	-	-

General Approach

The goal is information that is “good enough” to inform decision making. We will:

- Use the best available information
- Use the existing TP habitat and population model
- Expand and refine it as required with TAC input
- Identify critical gaps and uncertainties
- Elicit expert judgment to clarify critical uncertainties

PM Info Sheets will provide more info

Objective:

PM:

Overview of the PM

- Why it matters
- What it tells you and what it doesn't

How it's calculated

- Step by step

Key assumptions and uncertainties

- And what they mean for decision making

Results

- Details (charts, graphs) of how the alternatives compare

Synthesis and Next Steps

Session objectives:
Get agreement on next steps
Get agreement on roles

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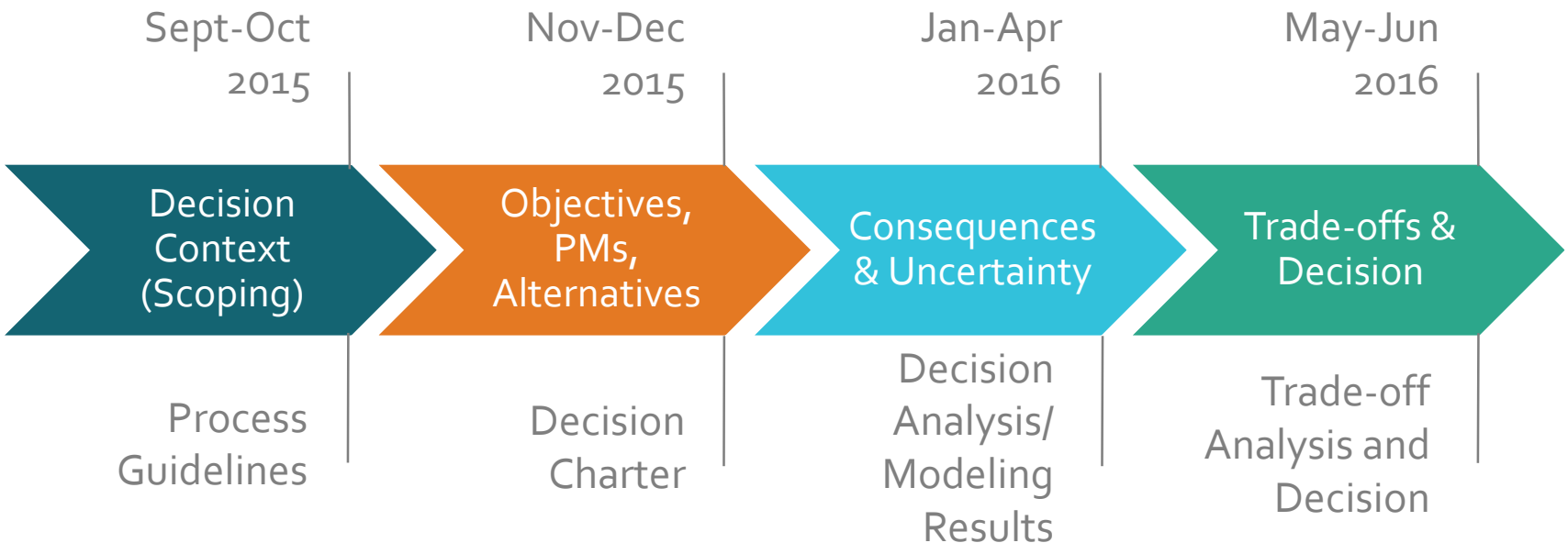
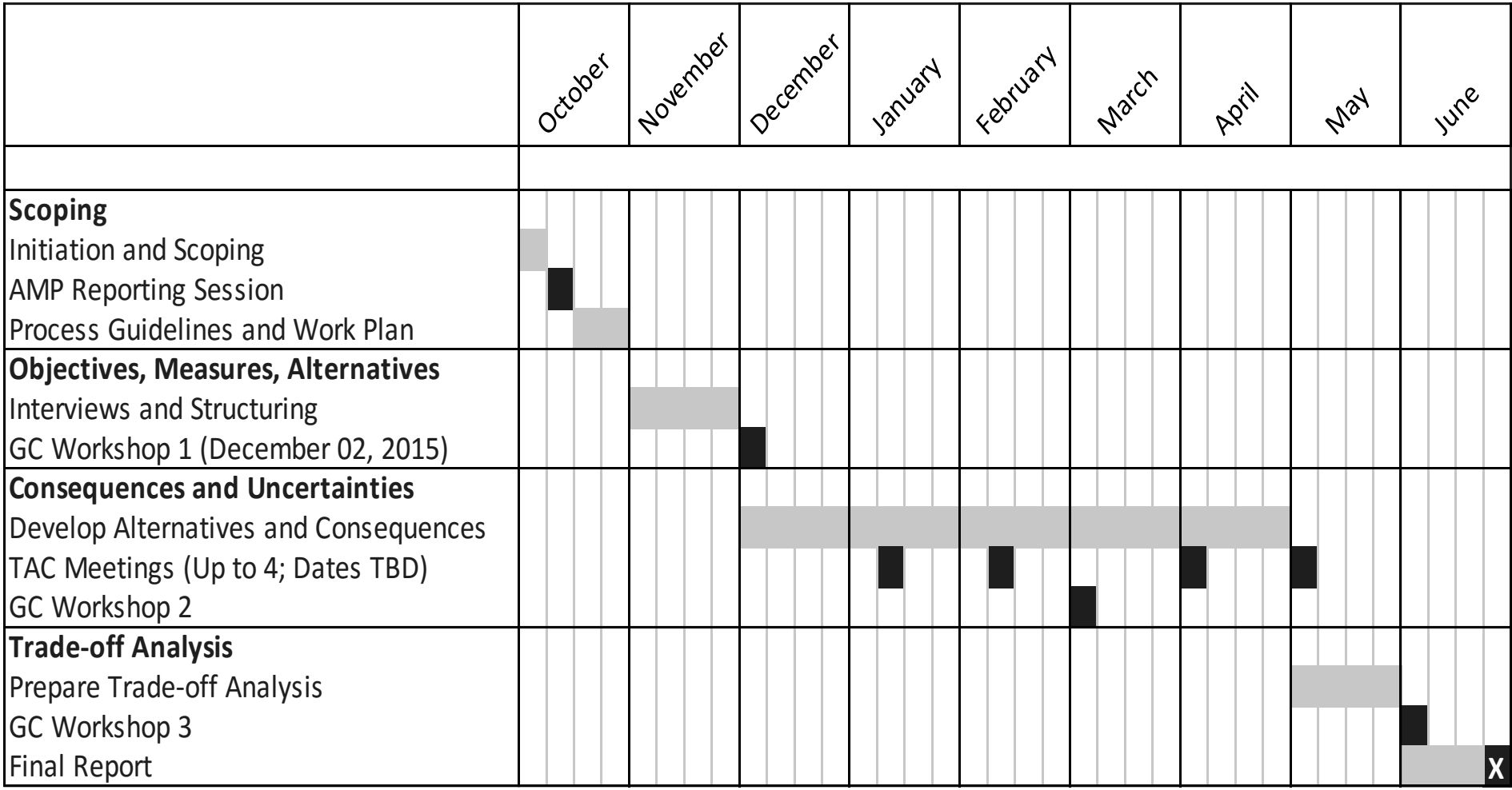
Tasks and Timeline

Schedule



Outcomes

Work Plan – from the Process G/Lines



Work Plan - Refined

When	Who	What
Jan	Compass / EDO	Develop preliminary alternatives, PMs and modeling
Feb	TAC 1	Round 1: Review and refine alternatives, PMs and modeling
March	GC 2	Provide direction with respect to key trade-offs and/or uncertainties
April	TAC 2	Round 2: Refine alternatives; address gaps and uncertainties
May	TAC 3 or subgroup	Round 3: As required, finalize key trade-offs
June	GC 3	Decision making

First TAC Meeting

When: Feb 10-11, 2016

Where: Kearney

What:

Review preliminary alternatives, PMs and models

Review initial modeling output (test)

Confirm/refine alternatives, PMs, models

Process Related Discussion Points

- TAC subgroups
  - Can we use subgroups for efficiency?
- Continuity and Communications
  - Reporting to / consulting with your constituency
  - Ensuring alternates are fully briefed and accept past decisions
- Meeting format/feedback
  - Changes to make for next time?

Thanks!