

Supplemental material for

“Case Study on Developing a Comprehensive Voluntary Environmental Performance and Process Standard for Alpine Resorts Using Four Business Management Principles”, by Bryan C. Foster, published in *Mountain Research and Development* 41(3), 2021. (See <https://bioone.org/toc/mred/41/3>)

TABLE S1 MARS mitigation indicators organized by alpine resort department.

Note: Criterion acronyms are CCMAQ, Climate Change Mitigation and Air Quality; EBDC, Environmental Building, Design and Construction; EEO, Environmental Education and Outreach; NHCR, Natural Habitat Conservation and Restoration; P7, Environmentally Preferable Product Purchases based on Performance and Price for Pollution Prevention; WCQ, Water Conservation and Quality; WRD, Waste Reduction and Diversion. Mitigation indicator acronyms are AC, Alternating Current; ATV, All Terrain Vehicles; BMPs, Best Management Practices for erosion control; BPI, Biodegradable Products Institute; BREEAM, Building Research Establishment Environmental Assessment Method; CAA, USA Clean Air Act; C&HW, Commercial and Hazardous Waste; CWA, USA Clean Water Act; EPA, USA Environmental Protection Agency; EPEAT, Electronic Product Environmental Assessment Tool standard; GG, Green Globes green building initiative; GHG, GreenHouse Gas; HVAC, Heating, Ventilation, and Air Conditioning; ICE, Internal Combustion Engine; IGV, Inlet Guide Vane; LED, Light Emitting Diode; LEED, Leadership in Environmental and Energy Design; LIDAR, Light Detection And Ranging; MSW, Municipal Solid Waste; NEPA, USA National Environmental Policy Act; PVC, PolyVinyl Chloride; R2, Responsible Recycling standard for electronics recyclers; SDS, Safety Data Sheets; SME, Small and Medium sized Enterprises; VFD, Variable Frequency Drive; YOY, Year Over Year; ZDHC, Zero Discharge of Hazardous Chemicals.

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Department	Criterion	Mitigation indicators	Material spatial	Material temporal	Material severity	Material total	Achieve subtot.
Administration	P7	All: cleaning prods., light bulbs, office prods., paints, paper prods./trash bags & SDS alt.	2	2	2	6	-
	WRD	All >10% red. paper use YOY incl. paperless trans.	1	1	1	3	9
Accounting	N/A	1-5% annual capex environ. projects	2	2	3	7	-
	CCMAQ	Scope 1 & 2 GHG reporting	1	1	1	3	10
Admin. support	P7	100% environ. pref. office prods	1	1	1	3	3
Design		100% environ. pref. new appl., furniture & flooring	1	1	2	4	4
Environ.	CCMAQ	>50% direct red. scope 1 & 2 GHGs	3	3	3	9	-
	WCQ	>25% red. water use (if app.)	1	3	3	7	-
	WRD	>50% div./red. MSW incl. single use plastics	1	2	2	5	-
Human res.		>25% div./red. C&HW	1	2	2	5	26
	EEO	Incentives for depts.	1	1	1	3	-
		EMS training	1	1	1	3	-
	CCMAQ	Restrict employ. ICE park & air travel	1	1	1	3	9
Info. serv.	WRD	100% elect. recycling at R2	1	1	2	4	-
	CCMAQ	100% EPEAT/Enrg. Star elect.	1	1	1	3	-
		Improve server rm. efficiency	1	1	1	3	10
Market/comm.	EEO	Honest & transp. comm.	2	2	2	6	-
		Environ. align. w/ sponsors	1	1	1	3	-
	WRD	Trash-free events	1	1	1	3	-
		Reduce print. pub. vol. by 50+%	1	1	1	3	15
Plan./engineer	CCMAQ	Reg. compliance: BMPs, CAA,					
	NHCR	CWA, NEPA (incl. endemic or endangered fauna & flora)	2	2	3	7	-
	WCQ						
Admin. subtot.	EBDC	100% cert. new buildings (BREEAM, LEED, GG, GS)	2	3	2	7	-
	CCMAQ	Top AC VFD new lifts, direct drive when avail.	1	1	2	4	18
							104





Department	Criterion	Mitigation indicators	Material spatial	Material temporal	Material severity	Material total	Achieve subtot.
Guest services Revenue gen.	P7	All: cleaning prods., light bulbs, office prods., paints, paper prods./trash bags & SDS alt	2	2	2	6	-
	WRD	All: >10% red. paper use YOY	1	1	1	3	9
Food & bev.	CCMAQ	Improve appl. efficiency	1	2	2	5	-
	WCQ		>50% low GHG refrigeration	1	2	2	5
	WRD	100% BPI certified grab-n-go & comm. compost.	1	2	2	5	-
	P7	>25% local & SME food suppliers	1	2	1	4	-
Mtn. hosts		Bio./org./regen. agri. sp. events & healthy/veg. menu options	1	1	1	3	22
	EEO	EMS training	1	1	1	3	3
Mtn. sport school		Nat. hist. ed. center	1	2	3	6	6
Resort guest & employee Idg.	P7	100% environ. pref. stock. prods.	1	2	2	5	-
	WRD	On-site compost & recycle coll	1	2	2	5	-
	CCMAQ	100% Energy Star & Water Sense new appl.	1	1	2	4	14
WCQ							
Retail		Improve wrhs. efficiency	1	1	1	3	-
	P7	Environ. preferable resort-branded merch.	1	1	2	4	-
		Environ. preferable clothing & sundries	1	1	2	4	-
	WRD	Uniform re-purposing	1	1	1	3	14
Ski patrol		Alum. & fiberglass signs, perm. posts	1	1	1	3	-
		Elim. mercury & PVC med. prods.	1	1	1	3	-
	WCQ	Replace nitro. expl. w/ GazEx	1	1	1	3	9
Ticket sales	WRD	100% re-usable/environ. pref. pass media	1	2	1	4	4
Guest serv. subtot.							81





Department	Criterion	Mitigation indicators	Material spatial	Material temporal	Material severity	Material total	Achieve subtotal.
Mtn. ops.	P7	All: cleaning prods., light bulbs, office prods., paints, paper prods./trash bags & SDS alt.	2	2	2	6	-
	CCMAQ	Bldgs., park, summer: >50% elect. tools	1	1	1	3	-
	WCQ	Lifts, vehicles: energy monitor.	1	1	1	3	-
	WCQ	Bldgs, snow: energy & water monitor.	1	1	1	3	-
	Lift & vehicle: 100% hot water or microbial parts cleaning	1	1	1	3	-	
Bldgs. & areas	WRD	All: >10% red. paper use YOY	1	1	1	3	21
	CCMAQ	LED conv., HVAC adj., low GHG A/C & red. light & noise pollu.	2	2	2	6	-
	WCQ	Install hi-speed dryers, water refill stations & waterless urinals	1	1	1	3	-
		100% building sewerage	1	1	1	3	-
		Imp. summer grounds manage.	1	1	1	3	-
Electrical	WRD	C&HW & MSW monitor & audit	1	2	1	4	19
	CCMAQ	Energy monitor. collab.	1	1	1	3	3
Lift main.	P7	Environ. pref. prods	1	1	2	4	4
Lift ops.	CCMAQ	Lift shack improvements	1	1	1	3	3
Parking		Electric buses	1	2	1	4	-
		>25% reduction via fee manage.	1	2	1	4	8
Park & pipe	WRD	Dirt half pipe & nat. mat. parks	1	1	1	3	3
Snowmaking	CCMAQ	100% elec. centrif. IGV VFD air compress. w/ heat recov. when app.	1	2	2	5	-
		100% low-e snowguns, nucleator use	1	2	2	5	-
		100% VFD centrifugal pumps & high effic. (IE3-4) motors	1	2	2	5	-
Summer rest.	NHCR	Check & repair air & water leaks	1	1	1	3	18
		<75% summer grooming piste area	2	1	2	5	-
		0% EPA cat. 1 or 2 pesticides	1	1	3	5	-
Vehicle main.	WCQ	Hydro-seeding, imp. rest. & wildfire risk. mit.	2	1	2	15	18
		Reg. compliance: effluent tests & fuel tank integrity	2	1	3	6	-
		>10% red. petrol. spill quantity YOY	1	1	2	4	-
	CCMAQ	>25% elec. ATVs & snowmobiles	2	1	1	4	-
		>25% elec. cars/trucks	2	1	1	4	-
Mtn. ops. subtotal		100% GPS/LiDAR snow depth groomers & tier 4+	1	1	1	3	21
							115
Achieve total							300

