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Records Request Assistant General Counsel Smithsonian Institution Office of General Counsel MRC 012 P.O. Box 37012 Washington, DC 20013-7012 Fax: 202-357-4310

04-January-2017

25-October-2021

29-November-2021

Preferred during COVID-19 pandemic: <u>SIRecordsReq@si.edu</u>

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Office of General Counsel

VIA ELECTRONIC MAIL

October 25, 2021

RE: Your Request for Smithsonian Records (request number 47647)

This responds to your request, dated and received in this Office on January 4, 2017, for the following records: Current Projects List, Facility Condition Assessment Report, OFEO Capital Plan, OFMR Confined Space Entry Program, OFMR Confined Space Entry Plan, and Real Property Inventory. The Smithsonian responds to requests for records in accordance with Smithsonian Directive 807 – Requests for Smithsonian Institution Information (SD 807) and applies a presumption of disclosure when processing such requests. The policy is posted on our website at http://www.si.edu/OGC/Records-Requests.

Enclosed are 109 pages of responsive material. Please be advised that certain information has been redacted consistent with SD 807.

Personal information, such as direct business telephone numbers, has been redacted consistent with SD 807 under Exemption 6, where disclosure of such information would constitute a clearly unwarranted invasion of the personal privacy of a third party with no overriding public interest.

Information that would reveal building security information has been redacted consistent with SD 807 under Exemption 7, which protects both investigatory and non-investigatory materials even when they have not been compiled in the course of a specific investigation. *Tax Analysts v. IRS*, 294 F.3d 71, 79 (D.C. Cir. 2002). The public release of this information would reveal information that could risk circumvention of the law or reasonably be expected to endanger the life or physical safety of any individual.

The exemption invoked appears over each redaction.

In addition, one page of draft material is being withheld as internal and deliberative material because it is not finalized, consistent with SD 807 under Exemption 5. For your information, the withheld material consists of the OFEO Capital Plan.

Office of General Counsel

Smithsonian Institution Building Room 302 MRC 012

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Street: 1000 Jefferson Drive SW • Washington DC 20560-0012

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This concludes the Smithsonian's response to your request. Thank you for your interest in the Smithsonian.

Best Wishes,

Claire C. Dean Assistant General Counsel

Enclosure

You have the right to appeal a partial or full denial of your request. Your appeal must be in writing, addressed to the Smithsonian Institution Office of General Counsel at the address below, <u>SIRecordsReq@si.edu</u>, or (202) 357-4310 (fax number), and made within sixty days from the date of this response letter. Your letter must explain your reason(s) for the appeal. The Smithsonian Deputy Secretary and Chief Operating Officer will decide your appeal and will respond to you in writing. You also have the right to request mediation services from the Office of Government Information Services (OGIS), within the National Archives and Records Administration, to resolve disputes about the withholding of information. Your request for mediation should include language authorizing OGIS to make inquiries on your behalf, including the right to review all documentation that OGIS deems necessary regarding your request. You should note that you understand that any documents you provide to OGIS, except those provided in confidence, may be copied and forwarded to Smithsonian Institution officials as a part of the dispute resolution process.

OFMR PRC	DJECT LIST FY 21		
RQT #	Title	Location	System
18129	Install a fume exhaust fan in the welding shop (Restoration	EMZ - Hazy	Safety
17695	Repair/replace sewer piping located underneath McDonalds	EMZ - Hazy	Plumbing
17700	Replace/repair AHU B3 fan (NW side of the main hanger)	EMZ - Hazy	HVAC
17285	Replace Catwalk lighting system along interior perimeter of the main hangar	EMZ - Hazy	Electrical
15010	Repair main sewer line from North Public Entrance	EMZ - Hazy	Exterior
10346	Replace double door store fronts	EMZ - Hazy	Exterior
18121	Replace DWRC Courtyard Scrim waterproofing	GPZ - DWRC	Plumbing
17694	Perform a design study of courtvard drainage -DS	GPZ - DWRC	Plumbing
17982	Lightning Arrest system has	GPZ - DWRC	Electrical
18011	Replace loading dock hydraulic	GPZ - Postal Museum	Safety
18015	Replace flush panel with flat stainless steel panel with cut	GPZ - Postal Museum	Plumbing
13850	Refinish wood floor	GPZ - Renwick	Interior
17713	Replace HVAC sensors of various type (COO2, RH, Temp, Static, etc.) building wide	NMZ - NMNH	HVAC
17714	Replace East Wing domestic hot water tank/heater	NMZ - NMNH	Plumbing
15090	Seal window Frames and insulation the walls around the window noted in Infrared Report	NewZ - CHSDM	Exterior
16435	Repair mechanical room pipe insulation, paint walls, and	NewZ - CHSDM	HVAC
17231	Repair exterior pavers	NewZ - NMAI-	Site
17277	Install ladders and platform in the loading dock to access	NewZ - CHSDM	Safety
17546,47,	Replace CHWP # 1,2,3 chill	NewZ - NMAI-	Plumbing
17571	Replace 6 double glass entrance doors to gallery	NewZ - NMAI- NY	Exterior
17603	Replace office window heaters (Archives and Director's	NewZ - Anacostia	HVAC
17607	Replace concrete exterior entrance pavers and light fixtures embedded in the concrete landing	NewZ - Anacostia	Exterior
17608	Repair, Water Proof and Resurface the Concrete Floor the Penthouse Mechanical Room	NewZ - Anacostia	Interior
17612	Replace high bay lights in public entrance vestibule	NewZ - Anacostia	Electrical
17613	Enclose the second floor Director Section Corner Office	NewZ - Anacostia	Interior
17691	Replace or insulate and install door sweeps on all exterior doors located mainly in the Miller Fox (Note: Infared Study Completed)	NewZ - CHSDM	Exterior
18134	Replace window panes in Café dining area	NewZ - CHSDM	Interior
18155	Replace damaged storm drain pipes	NewZ - NMAI- DC	Plumbing
NA	Services - Gordian SOPS DM - Projects	SI-WIDE	Contractor Support Site
17631	Repair/replace exterior lights	SMZ - Hirshhorn	Electrical
10158	Paint common areas - Sackler	SMZ - Quad	Interior

10177	The exterior alcove soffits are	SMZ -	Exterior
	stained by water seepage from	Hirshhorn	
	the interior, and by insect		
	nesting attracted by lighting		
	systems: causing a shoddy		
	annearance on a major		
	architectural feature		
	architectural reature.		
14538	Install accessible-capable	SM7 -	Safety
14000	nublic restrooms door- DS	Hirshborn	Surcey
16258	Flag Tower	SM7 - Froor	Roofing
18180	Design Study for Benairs -	SMZ - Quad	HVAC
10100	Boplace Quad critical	SIVIZ - Quau	INAC
1720/	Quad main Machanical Room	SM7 - Ouad	HVAC
1/304	is configured in multiple	SIVIE QUUU	
	vortical layors of aquipmont in		
	vertical layers of equipment in		
	a way that precludes access		
	ior service; which exacerbates		
	critical system failure due to		
	deferral of PM DS		
17/02	Paint and patch Quad	SM7 - Ouad	Interior
17403		Siviz - Quau	Interior
17522	Ronovato +/- 20 Privato	SM7 - Ouad	Plumbing
1/352	(Family) material	Siviz - Quau	Pluitibilig
1700	(Family) restroom	CM7 Qued	
11092	evicting buried utilities from	JIVIZ - QUOU	IIVAC
	the Qued to France Will		
	the Quad to Freer with		
17000	minimal disruption	CN47 5	
17693	(STUDY) Replace corroding	SIVIZ - Freer	HVAC
	numidification systems piping		
17815	Enlarge OFMR work space	SMZ -	Interior
	(design?) - To be confirmed	Hirshhorn	
	with opdc		
18118	Repair/replace HVAC system	SMZ - Quad	HVAC
	(Quad Loading Dock)		
TBD	STRI CMMR - Projects	STRI	Interior
17868	Repair CRC Roof Leaks -	SUZ - NMAI	Roofing
	Headdress Room Area	CRC	
	Replace roof top exhaust Fans		
17762	I thru 3	SUZ - MSC	HVAC
	Replace the tile flooring		
11639	throughout the OPL	SUZ - MSC	Interior
	Repair/replace MSC electrical		
17753	switchgear (captial?)	SUZ - MSC	Electrical
	Replace (overhaul) MSC		
	Chillers #1,#2, & 3 (centrifugal		
17756)	SUZ - MSC	HVAC
17758	Replace POD 3 cooling tower	SUZ - MSC	HVAC
	POD 5 chilled water piping		
	needs to be reconfigured		
17772	(design required?)	SUZ - MSC	HVAC
17767	POD 5 Replace #1, #2 & #3	SUZ - MSC	HVAC
11818	Duct cleaning	UNWZ - NZP	HVAC
13990,91	Repair Asphalt Roads &		
,92,93	Repair/maintain gravel roads	UNWZ - SCBI	Site
14459	Reseal/repair leaking moats	UNWZ - NZP	Exterior
	Seal & Sea Lion shore walk is		
	presenting a safety hazard to		
	staff, requiring redesign &		
14968,14	Replace/repair shore ice melt-		
967	DS	UNWZ - NZP	Structural
	AHU Replacement building 70,		
16737	80, 90	UNWZ - SCBI	HVAC
	keplace obsolete zone		
	temperature control systems		
16839	(GSB)	UNWZ - NZP	HVAC
	Replace zone temperature		
16840	control systems (great Cats)	UNWZ - NZP	HVAC
	Replace zone temperature		
	control systems (Conservation		
16841	Biology)	UNWZ - NZP	HVAC
	Perimeter fence clear and		
1/165	replace 1.25 mile section	UNWZ - SCBI	SITE
	Sectional tence clear and		
17166	replace 1.25 mile section	UNWZ - SCBI	Site
	Replace sectional fence (1 25		
17181	mile)	UNWZ - SCBI	Site
	Repair root 3rd floor roof,		
	buried root, and tower water		
17184	proofing	IUNWZ - NZP	Rooting

	Repair and seal outer wall		
17189	conduit NZP-DC Panda House Roof	UNWZ - NZP	Structural
	Replacement - Table		
17211	Discussion	UNWZ - NZP	Roofing
17015	Replace exhaust fan & duct		LIVAC
17215	Replace roof flashing	UNWZ - NZP	Roofing
17210			
17218	Shore up NZP-DC A-Lot erosion	UNWZ - NZP	Site
17220 17	Repair/Replace Wood steps at		
438	walkway	UNWZ - NZP	Site
	Replace two (2) AHU and AC		
17240	condenser Replace Asian Otter bot rock	UNWZ - NZP	HVAC
	elements (Need to confirm		
17298	project)	UNWZ - NZP	HVAC
17200	Replace guard rails (North		Cito
17509	Repair structural cracks Lower	UNVVZ - INZP	Site
17516	Bear	UNWZ - NZP	Interior
17740	Asia Trail Sloth Bear Tipa		Characterization
17749	впаде	UNWZ - NZP	Structural
	Replace Heat Pump in building		
17806	56/74/76/86/98/110/142	UNWZ - SCBI	HVAC
18008	keplace tailing cast iron	1 INW7 - N7D	Plumbing
10030	Crane Yard fencing and sheds	SINVE - NEP	
	have failed resulting in a		
18146	hazard	UNWZ - NZP	Site
	ACS-LSS Deferred		
	Maintenance Projects/Animal		
	Welfare Betterments	UNWZ - NZP	HVAC
17203	hardware	NMAAHC	Interior
17200	Replace boiler flue piping and	WMZ -	
17656	galvanized duct	NMAAHC	HVAC
	seals (Warranty Request	WM7 -	
17659	Review)	NMAAHC	Roofing
	Refurbish all espresso and	WM7 -	
17660	handles, and elevator cars)	NMAAHC	Interior
	Replace existing domestic		
17665	system (FY20 DM In Progress)	WMZ - NMAH	Plumbing
	Popair looking cowago linoc		
	behind wall leaking into the		
	collections storage area and		
	also allowing infestation of		
	pestsRm 4502 – ID leak and		
17674	abandoned ductwork or piping	WMZ - NMAH	Plumbing
			Ŭ
17600	Clean exterior façade/coronas	\A/A/7	Sito
τιορο	micro growth (see rqt 17760)	VVIVIZ - INIVIAH	SILE
	Clean exterior façade/coronas	WMZ -	
17689	micro growth	NMAAHC	Exterior
	egress doors insulation and		
13977	weather stripping	WMZ - NMAH	Exterior
		NewZ - NMAI-	
17545	Replace hot water pump #4	DC	Plumbing
	(Study) Electrical distribution		
	I		
	panel schedules and piping		
	valve charts are missing or		
	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaving		
<u>101</u> 65	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response	<u>SMZ</u> - Freer	Electrical
10165	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip	SMZ - Freer	Electrical
10165 14163	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip Hazards Phase Two (2021) Boiler Plant Tact Main Storm	SMZ - Freer SMZ - Quad	Electrical
10165 14163 11852	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip Hazards Phase Two (2021) Boiler Plant: Test Main Steam Pipe Integrity	SMZ - Freer SMZ - Quad UNWZ - NZP	Electrical Site HVAC
10165 14163 11852 16246	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip Hazards Phase Two (2021) Boiler Plant: Test Main Steam Pipe Integrity Replace AHU3 (Cage 34)	SMZ - Freer SMZ - Quad UNWZ - NZP UNWZ - NZP	Electrical Site HVAC HVAC
10165 14163 11852 16246	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip Hazards Phase Two (2021) Boiler Plant: Test Main Steam Pipe Integrity Replace AHU3 (Cage 34) (PCN - MOD OPDC) Replace there (0) decustion	SMZ - Freer SMZ - Quad UNWZ - NZP UNWZ - NZP	Electrical Site HVAC HVAC
10165 14163 11852 16246	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip Hazards Phase Two (2021) Boiler Plant: Test Main Steam Pipe Integrity Replace AHU3 (Cage 34) (PCN - MOD OPDC) Replace three (3) domestic hot water holding tanks	SMZ - Freer SMZ - Quad UNWZ - NZP UNWZ - NZP	Electrical Site HVAC HVAC Exterior
10165 14163 11852 16246 16477	panel schedules and piping valve charts are missing or incomplete; creating hazard in service tasks and delaying emergency response SMZ Sidewalk Has Trip Hazards Phase Two (2021) Boiler Plant: Test Main Steam Pipe Integrity Replace AHU3 (Cage 34) (PCN - MOD OPDC) Replace three (3) domestic hot water holding tanks Replace corroded O/S air duct	SMZ - Freer SMZ - Quad UNWZ - NZP UNWZ - NZP UNWZ - NZP	Electrical Site HVAC HVAC Exterior

	Replace Failed pool surface		
18087	sealant / pain (otter)	UNWZ - NZP	Structural
	intake is straining HVAC		
	equipment and affecting		
	ability to control temp in		
	building Clean/remove debris		
17677	intakes ground level	WMZ - NMAH	HVAC
	Install variable frequency		
15014	drives on four (4) chillers	EMZ - Hazy	HVAC
	Phase one-The visitor's park		
	lot at Hazy currently has poor		
	lighting. This poor lighting		
	generates a safety concern for		
	the guest. The solution is to		
	replace system fixtures with		
10359	LED fixtures.	EMZ - Hazy	Site
	Replace failing dust collection		
18123	system (Apollo Dr)	GPZ - SERC	Safety
	(PCN02) Paint and caulk south-		
12364	side exterior windows and sills	GPZ - DWRC	Exterior
	Replace Hall 8 and Hall 21		
17261	men s and women s restrooms		Interior
1/201	Install loading dock bird	New7 - NMAI-	Interior
17226	netting	DC	Site
	Replace KEF #3 kitchen	NewZ - NMAI-	
17559	exhaust fan	DC	Plumbing
	PCN 3 Quad Repair Pavilion		
	Vestibule Doors, Hardware, &		
16251	Gaskets on Windows for	SM7 - Ouad	Extorior
17366	Replace stairwell carpets	SUZ - Quau	Interior
1,000	OPL Air Scrubber has	002 1100	
17763	exceeded its life cycle.	SUZ - MSC	HVAC
17768	MSC Main & POD 3 Penthouse		
17755	 rebuild steam stations 	SUZ - MSC	HVAC
	Replace chilled water pumps		
	and motors (Pod 3 Penthouse)		
17770,17	& Heating Hot Water Pumps		
771	#1-3 (MSC Boiler Plant)	SUZ - MSC	HVAC
	Replace two (2) HVAC Liebert		
17978,	units in Garber Bldg. 19 & two	CUIZ Carbor	
1/9/9	(2) IN Blug. #28	SUZ - Garber	HVAC
18137	Replace NMAI-CRC carpet	CRC	Interior
17769	Replace POD 3 humidifiers	SUZ - MSC	HVAC
	Amazonia: Replacement of		
14556	AHU 2	UNWZ - NZP	HVAC
	Replace Hot Water and Chilled		
	AHII# 5 in Small Mammals		
17568	House	UNWZ - NZP	Plumbing
	Replace Gibbons Ridge HVAC	-	
	package unit failing 15 plus		
17745	years old	UNWZ - NZP	HVAC
17075	Replace HVAC units 1-4 Seal		
1/0/3	COat		IVAC
	Seal floors fox fire magnesium		
17683	aggregate (mech rooms)	WMZ - NMAH	Interior
	Replace four (4) ventilation		
10120	systems for the electrical Low		
18130	Replace reverse osmosis	EIVIZ - Hazy	HVAC
18061	system	GPZ - Renwick	HVAC
	Revitalize at Miller Fox House	NewZ -	
13331	passenger elevator	CHSDM	Conveyances
		NewZ - NMAI-	
18383	Install AHU 6 & 7	NY	HVAC
	Plumbing dba Kingtiy	SI-WIDE	Plumhing
	Central Contract Siemens	SI-WIDE	Site
	Central Contract Kinetix	SI-WIDE	Plumbing
NA	Irrigation Maxicom contract	SI-WIDE	Site
NA	Environmental controls	SI-WIDE	Site
	Replace Pneumatic Controls		
18117	Reheat System	SM7 - Ouad	HVAC
1011/	PCN1 Replace Exhaust Fans11-	SIVIZ - QUOU	
17754	12 & 13-14	SUZ - MSC	Ηνας

(PCN #) Replace 4" drain 17484 line UNWZ - NZP Plumbing	
17484 line UNWZ - NZP Plumbing	
Renair and seal coat failing	
17668 terrazzo floors (building wide) WMZ - NMAH Interior	
Install explosion proof outlets	
and breaker panel (wood	
1/133 shop) GPZ - Renwick Electrical	
17959 Replace boiler exhaust system GPZ - DWRC HVAC	
PCN 03 Bank Stabilization	
JAVA Trail - MOD to 20210 GPZ - SERC Site	
15382,15 264 1552 Poplace Chiller 2, 4, 8, 5	
8 (overhaul) NMZ - NMNH HVAC	
Paving Repairs and Top Coat NMZ - Ft.	
15628 Surface Replacement Pierce Site	
17886 Replace base camp generator SAO-A7 Electrical	
Repair 11 roof drains under	
16492 the Haupt Garden SMZ - Quad Roofing	
Experiencing flooding from	
some exterior drains - need to	
study entire systemSnake	
17676 and camera all exterior drains WMZ - NMAH Plumbing	
(Cory House) Abatement of	
17822 entire structure GP7 - SERC Interior	
IH services CORY House GPZ - SERC Exterior	
Replace six (6) electric hot NewZ - NMAI-	
16017 water heaters DC Plumbing	
1/180,17 179 1727 Replace waste tank ejector New7 - NMAI-	
6 pumps; exhaust fan NY HVAC	
Replace SE-1 triplex sewage	
injector pump and Replace NewZ - NMAI-	
17562 Hot water Heaters DC Plumbing	
1/562 Hot water Heaters DC Plumbing SMZ - Arts Replace existing Sealed and	
1/562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts and 14456 Window In Steam Station Industries HVAC	
1/562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts and 14456 Window In Steam Station Industries HVAC PCN 22 & 23 Repairs in Pump SMZ - SMZ -	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Replace MSC house air tank, compressors, and air dryers SUZ - MSC	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Replace MSC house air tank, compressors, and air dryers SUZ - MSC HVAC Additional Harscape Repairs SUZ - MSC	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump Room SMZ - Replace MSC house air tank, SIB/Castle HVAC 17766 compressors, and air dryers SUZ - MSC HVAC Additional Harscape Repairs MSC PCN 1 SUZ - MSC Site 18469 Panda Cafe Drain Inspection UNWZ - NZP Roofing	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump Room SMZ - Replace MSC house air tank, SIB/Castle HVAC 17766 compressors, and air dryers SUZ - MSC Additional Harscape Repairs MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Vance	
17562 Hot water Heaters DC Plumbing Replace existing Sealed SMZ - Arts 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Replace MSC house air tank, SUZ - MSC Additional Harscape Repairs SUZ - MSC MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant	
17562 Hot water Heaters DC Plumbing Replace existing Sealed and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump Room SMZ - Arts 17766 PCN 22 & 23 Repairs in repairs Replace MSC house air tank, Additional Harscape Repairs SUZ - MSC MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP Roofing PCN27 Steam Station Mane Restaurant UNWZ - NZP 15031- Replace/repair restroom 15216 Reoridor Floor and soale	
17562 Hot water Heaters DC Plumbing Replace existing Sealed and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Replace MSC house air tank, SUZ - MSC 17766 compressors, and air dryers SUZ - MSC Additional Harscape Repairs MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant UNWZ - NZP Restaurant UNWZ - NZP HVAC 18316 corridor floor and seals EMZ - Hazy Replace air conditioning EMZ - Hazy Interior	
17562 Hot water Heaters DC Plumbing Replace existing Sealed and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Replace MSC house air tank, SUZ - MSC 17766 compressors, and air dryers SUZ - MSC Additional Harscape Repairs MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant UNWZ - NZP 18316 corridor floor and seals EMZ - Hazy Replace air conditioning system serving the east wing EMZ - Hazy	
17562 Hot water Heaters DC Plumbing Replace existing Sealed and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Additional Harscape Repairs MSC PCN 1 SUZ - MSC MSC PCN 1 SUZ - MSC Site 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant UNWZ - NZP 18316 corridor floor and seals EMZ - Hazy Interior Replace air conditioning system serving the east wing 17973 Pepco feeder vault NMZ - NMNH	
17562 Hot water Heaters DC Plumbing Replace existing Sealed and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump Room SMZ - Arts and 17766 PCN 22 & 23 Repairs in Pump Room SIB/Castle 17766 Replace MSC house air tank, Additional Harscape Repairs MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant UNWZ - NZP 15031- Replace (repair restroom corridor floor and seals EMZ - Hazy 18316 corridor floor and seals EMZ - Hazy 17973 Pepco feeder vault NMZ - NMNH NMNH-Apply watertight NMZ - NMNH	
17562 Hot water Heaters DC Plumbing 17562 Hot water Heaters DC Plumbing 17562 Replace existing Sealed and 14456 Window In Steam Station Industries HVAC 14456 PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC 17766 compressors, and air dryers SUZ - MSC Additional Harscape Repairs MSC PCN 1 SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant UNWZ - NZP 15031- Replace repair restroom EMZ - Hazy 18316 corridor floor and seals EMZ - Hazy 17973 Pepco feeder vault NMZ - NMNH NMNH-Apply watertight NMZ - NMNH 17359 coating on AHUS NMZ - NMNH 17601,17 Repair Penthouse siding, NewZ -	
17562 Hot water Heaters DC Plumbing 17562 Hot water Heaters SMZ - Arts Replace existing Sealed and 14456 Window In Steam Station Industries PCN 22 & 23 Repairs in Pump SMZ - Room SIB/Castle HVAC Replace MSC house air tank, SUZ - MSC HVAC Additional Harscape Repairs MSC PCN 1 SUZ - MSC SUZ - MSC Site SUZ - MSC 18469 Panda Cafe Drain Inspection UNWZ - NZP PCN27 Steam Station Mane Restaurant UNWZ - NZP 15031- Replace ir conditioning system serving the east wing 17973 Pepco feeder vault NMZ - NMNH NMNH-Apply watertight NMZ - NMNH HVAC 17359 coating on AHUS NEZ - NMNH 09 windows and Roof ACM Anacostia Exterior	
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	Install sump pumps to remove		
17679	water and prevent water	W/M7 - NMAH	Plumbing
18007	WWTP at SERC	GPZ - SERC	Plumbing
	Modernize elevator #9 and		
15315	elevator # 10	NMZ - NMNH	Conveyances
	(b) (7)(E))	
	Repair Ridge Dorm Roof A,		
1/880,1/	Gamma Ray Bidg. Root D		
2	Protection	SAO-AZ	Roofing
	SMZ Elevator Cab		
	Refurbishment at NMAFA,		
16253	Sackler, and Ripley	SMZ - Quad	Conveyances
17974	(Garber Bldg #6 & #11)	SUZ - Garber	HVAC
	Replace roof vent rack and		
	pinion vent operators (PCN 2)	SUZ -	
11667	mod existing FY 20	Greenhouse	HVAC
18136	cloth	Greenhouse	Interior
	Replace POD-5, Chiller #2		
	Compressor VDS power		
18368	assembly	SUZ - MSC	HVAC
17300	Replace AHU 1.2 & 5 Vet		
18341	Hospital	UNWZ - NZP	HVAC
	Replace (overhaul) chiller		
18030	compressor 1-4	WMZ - NMAH	HVAC
	Station	WMZ - NMAH	Plumbing
	Replace step chains on		
16755	escalators 3 & 4	EMZ - NASM	Conveyances
17001	Replace seal & Bearing on		
17301	Worn carpet in the Office of	GFZ - DWRC	INAC
	the Sackler Registrar is		
	contaminated and beyond		
	(handling collections) is		
	compromised by the condition		
17139	of the carpet;	SMZ - Quad	Interior
	CRC, Water Condensation -		
	Headdress - Collection Space	SUZ - NMAI	
18347	Roomphase 1)	CRC	HVAC
	MOD FY20 2054504 Re-stripe		
	phase one asphalt (main		
18132	the museum)	FM7 - Hazy	Sito
10152	PCN 2 20210- Repair to	LIVIZ - HOZY	
	Contees water shed hiking		
17525	trail	GPZ - SERC	Site
11878	Replace Main Gate	NIVIZ - Ft. Pierce	Exterior
11020	Repair Mt Hopkins Road (Gate		Exterior
	(km 12.6) and the Ridge (km		
18152	16 9)) PCN1	SAO-AZ	Site
NA	CMMR support	SI-WIDE	Contractor Support
NA .	SG DM Projects Tracking	JI-WIDL	
NA	Budget Line	SI-WIDE	Site
	PCN 1 -Replace foggy IGU		
	WINDOW IN PAVILION at the	SM7 - Ound	Exterior
	Repair MSC Pod Lighting	JIVIZ - QUOU	
18328	Meter deficiencies	SUZ - MSC	Electrical
17628	Green Roof leaking	UNWZ - SCBI	Roofing
	The Hazy visitors parking area		
	is deteriorated. Resurfacing of		
17728	E9 & E10	EMZ - Hazy	Site
	Seal and coat two (2) AHUs	NMZ - Ft.	
18138	(PCN1 20501)	Pierce	HVAC
15902	Replace SCRI Hay Barn roof	11 N N/7 - SCR	Rooting

FY2019 Facility Condition Assessment Report

OFFICE OF FACILITIES MANAGEMENT AND RELIABILITY | Systems Engineering Division



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Executive Summary

The data included in this report was collected on September 30, 2019, the last day of the fiscal year, with an additional interim update applied in late January due to staffing changes and missing data points. The data in our management system is live and changes from day to day as updates are inputted. Information that is updated includes, but is not limited to, on-going Smithsonian Institution (SI) building construction and demolition projects, condition assessment input, asset data, and fluctuations in industry standard estimated costs of construction per square foot.

Prior to 2007 SI performed detailed, traditional Facility Condition Assessments (FCA) that itemized system deficiencies and the costs associated to repair or correct those deficiencies. The method was both time consuming and costly. The cost to benefit ratio of the information derived could not be justified. In 2007, SI adopted the Deferred Maintenance and Repair (DM&R) Parametric Estimating technique which included the backlog of maintenance and minor repair costs, System Condition Index (SCI), and Facility Condition Index (FCI)¹. Although this approach is not as detailed, it has provided more realistic representations of the overall condition of our systems and facilities, a more holistic understanding of our lifecycle costs, and meets the intent of performing condition assessments. A thorough methodology of this approach is discussed in detail in this report, but briefly as stated by the National Academy of Sciences:

"Condition assessment surveys are a recognized, valid facilities management tool for identifying and reporting maintenance and repair needs."²

From 2007 to 2013, the data was gathered, maintained, and processed in a stand-alone Excel[™] spreadsheet. In 2013 the information was manually transferred from the spreadsheet into SI's Work Management System Tririga[®]. Since that time, the data has been entered and tracked within that system.

As we look to the future, we will continue to use the Facility Condition Assessments as a tool to guide judicious project integration into both our short- and long-range maintenance and capital planning. Our next step, the process of adding condition information at the asset level into our Facility Center system has just begun. The intent is to supplement the parametric assessments with the detail of the Knowledge Based Approach³ on critical assets to better analyze which facilities and systems require attention. The assessments team from OFMR has also been directly involved with the Office of Planning, Design, and Construction (OPDC) in the implementation of the new Facilities Requirements Database (FReD) tool that will support converting assessment findings into specific repair or capital revitalization projects required to

¹ The SI definition for FCI is based on FASAB Standard Number 6 (1996) as reported in Federal Facilities Council Technical Report No. 141: Deferred Maintenance Reporting for Federal Facilities, 2001.

² Maintenance Reporting for Federal Facilities, Federal Facilities Council Report 141, 2001

³ For further discussion regarding KBA refer to: Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities, National Research Council of the National Academies, 2012.

correct deficiencies. The goal of the assessments team is to analyze the condition of our assets and facilities. Data collected is used to create metrics, findings, and information to enable our facilities teams to support the SI mission in an efficient, fiscally responsible manner.

Our approach has been to physically survey the entire inventory of SI owned and maintained facilities on a three-year cycle and conduct "desk audits" in the interim years (2017 & 2018). Moving forward with a Knowledge Based Assessment approach will help us analyze the natural deterioration that occurs over the lifecycle of a facility or system, such as, the influence of age, usage, maintenance, environment, operator performance, as well as, abnormalities that the systems/facilities that are approaching a critical phase in their life cycle that pose the highest risk of failure. Incorporating the real-time data of on-demand tickets, service calls, and asset condition will help generate a preventative maintenance schedule that best utilizes our limited resources. Accomplishing this level of integration requires that all systems be linked through a common database and can utilize maintenance, repair and contract accomplishments (both maintenance and capital funded), as well as the predictive technologies performed on systems and equipment.

Himanshu Patel Office of Facilities Management and Reliability Systems Engineering Division Acting Associate Director

Findings and Recommendations

This report summarizes the condition assessment update for FY19 and includes all properties that are currently maintained by the Smithsonian.

In FY19, SI reported a total inventory of 685 buildings, 207 structures, and 102 land parcels totaling 28,462 Acres. This report also includes properties that SI has a level of financial responsibility to maintain and repair, but may not be SI owned, including some leased facilities.

This FY19 assessment is a full field assessment of all buildings using SI contractors and internal subject matter experts. Condition data from other sources was resourced and included, such as roof condition data from Facility Center and other records or databases within OFMR that track the condition of our facilities and systems. OFMR Zone and Building Managers provided input as well. In addition, both the Capital and Maintenance Programs were reviewed and any project work that was completed and deemed to significantly upgrade or improve the condition of a facility or system was noted and the rating adjusted accordingly.

CRV, DM&R, and FCI - The Results

For FY19, the total Current Replacement Value (CRV) of properties maintained is \$9.195 billion with a Deferred Maintenance and Repair (DM&R) cost of \$1.099 billion, resulting in an overall FCI of 88.0%. This represents a slight decrease from the FY16 FCI of 89.0%. Although this score still puts SI in the poor condition category, when considering the stagnant funding for maintenance and repairs for SI facilities, the rate of decline was not as severe as anticipated. SI is currently funded at less than half of the low end of the recommended 2-4% of CRV maintenance funding recommended by the National Research Council industry standard developed by the National Research Council (NRC 1990). From FY15 to FY18 the overall FCI of 89.0%. In those three years the CRV was \$8.126 B, with a DM&R of \$898.2 M and an overall FCI of 89.0%. In those three years the CRV increased by about 13% (due both to the additional facilities surveyed and the annual adjustment for increased construction costs) but deferred maintenance increased by \$200.8M.

This is a summary of data collected from FY15 to FY19, which includes information from older FCA reports as well.

FY	2015	2016	2017	2018	2019
DM&R	\$808.9M	\$898.2M	\$936.9M	\$1,021.1M	\$1.099B
FCI	88.8%	89.0%	88.9%	88.4%	88.0%
CRV	\$7.074B	\$8.126B	\$8.447B	\$8.770B	\$9.195B

Table 1 - DM&R and FCI values for FY15 - FY19

Tables 2, 3, and 4 present data from zones established by OFMR to organize facilities within a geographic space. For a full listing of the zones and the facilities each entail, please visit https://sinet.sharepoint.com/sites/PRISM2/SIOrganization/OFEO/OFMR/Zones/Pages/Home.aspx.

CRV		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	Total
	2013	\$21,759,383	\$166,820,665	\$164,516,536	\$112,191,407	\$59,058,311	\$121,184,091	\$187,915,796	\$219,414,176	\$1,052,860,366
EMZ	2016	\$30,556,675	\$233,911,161	\$233,017,150	\$157,888,991	\$232,035,815	\$171,047,434	\$186,620,520	\$315,344,332	\$1,560,422,078
	2019	\$27,959,721	\$215,571,385	\$215,054,148	\$145,205,557	\$214,651,658	\$155,952,313	\$170,247,048	\$288,850,417	\$1,433,938,406
1000	2013	\$9,680,652	\$77,875,319	\$68,652,062	\$53,673,690	\$77,348,276	\$50,344,845	\$54,921,650	\$91,536,083	\$484,032,577
GPZ	2016	\$10,192,249	\$82,011,280	\$72,264,813	\$56,530,657	\$81,454,339	\$52,994,197	\$57,811,851	\$96,353,085	\$509,612,471
	2019	\$11,304,042	\$92,504,640	\$78,987,074	\$64,244,535	\$91,732,208	\$57,923,854	\$63,189,659	\$105,316,099	\$565,202,111
	2013	\$35,876,431	\$238,034,953	\$230,957,600	\$187,109,370	\$223,660,222	\$116,190,297	\$130,492,465	\$281,933,500	\$1,444,254,839
NMZ	2016	\$42,584,427	\$282,397,975	\$273,973,565	\$221,982,877	\$265,317,269	\$137,795,031	\$154,731,521	\$334,533,528	\$1,713,316,194
11.1	2019	\$54,028,181	\$358,064,740	\$347,363,284	\$281,547,322	\$336,403,756	\$174,572,100	\$196,077,762	\$424,026,714	\$2,172,359,804
	2013	\$2,271,220	\$11,236,577	\$10,482,970	\$8,975,663	\$7,819,341	\$3,648,544	\$3,708,397	\$11,954,830	\$60,097,542
SAO	2016	\$2,438,544	\$13,911,672	\$11,957,742	\$10,741,795	\$8,398,953	\$4,335,482	\$4,313,825	\$31,969,884	\$88,067,897
· · · · ·	2019	\$2,693,183	\$15,181,988	\$12,831,206	\$11,752,443	\$9,278,135	\$4,738,349	\$4,502,995	\$32,316,133	\$110,181,323
1-5-1	2013	\$4,631,652	\$65,879,995	\$39,089,611	\$53,273,065	\$46,861,662	\$53,481,783	\$29,029,999	\$52,492,718	\$344,740,484
SERC	2016	\$6,091,086	\$90,464,382	\$56,499,067	\$72,278,617	\$63,045,608	\$65,795,735	\$39,198,155	\$75,539,666	\$468,912,316
1	2019	\$129,973	\$13,903,515	\$13,131,199	\$10,242,223	\$10,124,911	\$5,799,012	\$3,866,997	\$17,689,837	\$75,299,435
1 - 1	2013	\$31,691,109	\$215,790,458	\$171,598,322	\$180,687,597	\$237,876,971	\$174,437,246	\$190,163,901	\$383,493,339	\$1,585,738,944
SMZ	2016	\$23,809,912	\$155,324,318	\$108,806,648	\$142,314,808	\$178,579,537	\$130,954,514	\$142,867,962	\$307,898,806	\$1,190,556,504
	2019	\$29,762,911	\$197,543,861	\$146,168,445	\$174,509,348	\$223,227,575	\$163,696,011	\$178,586,845	\$374,717,840	\$1,488,790,018
	2013	\$1,466,415	\$34,835,644	\$27,450,774	\$13,883,456	\$18,151,755	\$8,131,775	\$8,138,844	\$52,511,705	\$164,570,367
STRI	2016	\$1,731,014	\$39,321,161	\$31,434,522	\$16,119,276	\$20,999,212	\$9,744,728	\$10,334,276	\$61,294,475	\$190,978,664
/ creating	2019	\$1,842,114	\$45,308,174	\$37,672,735	\$19,457,866	\$26,371,008	\$13,302,703	\$16,212,799	\$70,823,740	\$231,820,507
	2013	\$6,179,110	\$46,382,373	\$49,091,533	\$32,174,953	\$43,844,649	\$31,880,482	\$38,005,788	\$81,949,417	\$329,508,305
Suitland	2016	\$6,504,321	\$49,204,428	\$52,054,816	\$34,141,320	\$46,527,284	\$33,822,601	\$40,372,296	\$86,908,244	\$349,535,310
Julianu	2019	\$6,993,509	\$52,986,955	\$56,167,161	\$36,833,100	\$49,998,915	\$36,321,236	\$43,493,703	\$94,342,168	\$377,152,996

Table 2 – Current Replacement Value (CRV) by System and Zone

CRV		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	Total
	2013	\$3,844,306	\$73,252,675	\$58,846,965	\$40,834,745	\$42,731,895	\$41,240,907	\$30,659,102	\$141,661,621	\$433,072,217
UNWZ	2016	\$4,134,547	\$78,043,440	\$62,767,946	\$43,262,591	\$45,397,606	\$43,960,685	\$32,592,689	\$151,044,558	\$461,204,062
	2019	\$4,625,246	\$87,273,010	\$69,147,925	\$49,394,304	\$52,094,487	\$48,707,481	\$36,321,910	\$161,052,904	\$511,512,397
	2013	\$14,788,895	\$111,207,999	\$111,190,675	\$74,109,244	\$111,159,946	\$81,405,942	\$88,819,674	\$148,141,983	\$740,824,359
WMZ	2016	\$31,830,395	\$239,034,584	\$239,016,348	\$159,325,419	\$238,984,002	\$175,137,721	\$191,073,218	\$318,570,305	\$1,592,971,992
	2019	\$28,457,052	\$213,766,530	\$213,746,389	\$142,476,815	\$213,710,665	\$156,591,700	\$170,842,645	\$284,864,687	\$1,424,456,483
NZ (Z)	2019	\$13,802,306	\$140,281,688	\$103,527,964	\$105,772,367	\$113,763,473	\$106,640,552	\$82,824,505	\$138,051,514	\$804,664,369
	2013	\$132,189,171	\$1,041,316,660	\$931,877,048	\$756,913,191	\$868,513,031	\$681,945,912	\$761,855,616	\$1,465,089,371	\$6,639,700,000
Total	2016	\$159,873,170	\$1,263,624,401	\$1,141,792,618	\$914,586,351	\$1,180,739,625	\$825,588,128	\$859,916,313	\$1,779,456,882	\$8,125,577,488
	2019	\$181,598,237	\$1,432,386,486	\$1,293,797,529	\$1,041,435,879	\$1,341,356,791	\$924,245,312	\$966,166,869	\$1,992,052,052	\$9,195,377,850

DM&R		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	Total
	2013	\$2,153,763	\$10,992,370	\$2,364,306	\$44,949,272	\$1,730,508	\$8,731,622	\$71,827,639	\$2,285,531	\$145,035,011
EMZ	2016	\$611,134	\$4,737,498	\$132,627,832	\$57,060,091	\$13,241,111	\$10,507,676	\$77,093,117	\$25,008,623	\$320,887,081
	2019	\$559,194	\$4,377,661	\$144,570,255	\$63,459,347	\$14,800,650	\$11,095,990	\$86,426,231	\$28,128,991	\$353,515,595
	2013	\$1,147,471	\$1,168,447	\$756,909	\$5,021,192	\$3,871,508	\$1,450,950	\$20,870,227	\$100,921	\$34,387,626
GPZ	2016	\$203,845	\$2,552,989	\$6,429,743	\$1,943,334	\$734,870	\$943,029	\$4,629	\$963,531	\$18,400,755
	2019	\$311,048	\$3,168,193	\$7,138,964	\$2,446,849	\$1,979,968	\$1,034,667	\$5,079,274	\$1,053,161	\$22,212,125
	2013	\$1,487,782	\$24,710,489	\$7,208,030	\$20,117,101	\$12,793,693	\$8,300,070	\$23,762,915	\$768,288	\$99,148,368
NMZ	2016	\$2,694,882	\$20,936,310	\$15,979,676	\$23,898,477	\$20,818,012	\$9,868,837	\$13,977,131	\$3,352,530	\$111,525,854
	2019	\$3,424,095	\$26,675,130	\$20,300,649	\$30,419,557	\$26,415,336	\$12,508,609	\$17,803,377	\$4,311,094	\$141,864,556
	2013	\$907,977	\$211,419	\$1,299,214	\$259,303	\$221,454	\$134,685	\$580,981	\$75,378	\$3,690,412
SAO	2016	\$975,190	\$371,528	\$244,419	\$256,599	\$329,747	\$143,026	\$738,254	\$1,829,181	\$4,887,942
	2019	\$85,935	\$1,307,231	\$1,043,884	\$1,544,367	\$885,363	\$345,814	\$1,586,801	\$2,459,494	\$7,724,440
	2013	\$223,253	\$4,339,458	\$842,451	\$3,989,001	\$1,341,722	\$3,272,459	\$2,970,969	\$695,820	\$17,675,132
SERC	2016	\$775,154	\$3,900,516	\$440,447	\$7,853,389	\$1,131,873	\$3,046,520	\$1,572,601	\$651,213	\$19,371,713
	2019	\$2,450	\$580,876	\$546,132	\$739,270	\$396,360	\$288,499	\$463,366	\$817,350	\$3,898,807
	2013	\$4,874,224	\$36,370,892	\$3,177,418	\$43,923,008	\$32,629,135	\$35,927,352	\$28,796,126	\$28,000,779	\$213,698,933
SMZ	2016	\$6,170,616	\$38,432,169	\$8,225,940	\$36,127,529	\$23,441,979	\$25,584,187	\$39,658,293	\$32,709,938	\$210,350,650
	2019	\$8,724,854	\$51,267,624	\$36,560,325	\$46,348,378	\$32,316,405	\$34,046,583	\$46,074,118	\$41,177,625	\$296,558,007
	2013	\$35,932	\$8,573,798	\$8,685,701	\$1,784,151	\$2,425,431	\$866,919	\$3,442,185	\$12,670,648	\$38,484,765
STRI	2016	\$73,251	\$9,679,398	\$5,103,255	\$3,481,604	\$3,274,818	\$1,163,576	\$3,817,213	\$6,915,222	\$33,508,338
	2019	\$225,017	\$13,219,332	\$6,060,352	\$4,688,428	\$5,754,744	\$2,006,511	\$6,459,702	\$6,442,488	\$44,876,114
	2013	\$154,635	\$1,003,079	\$1,159,217	\$802,763	\$496,092	\$733,979	\$13,057,265	\$4,871,741	\$22,278,771
SUIT (Suitland)	2016	\$171,663	\$1,097,694	\$4,278,632	\$850,725	\$3,590,270	\$773,975	\$23,863,362	\$6,633,238	\$41,259,559
		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	Total

Table 3 – Deferred Maintenance and Repairs (DM&R) by System and Zone

	2019	\$237,133	\$1,299,604	\$4,831,026	\$932,472	\$4,024,777	\$744,811	\$14,613,581	\$7,486,893	\$32,967,411
	2013	\$895,873	\$12,099,317	\$7,164,562	\$5,724,399	\$3,860,442	\$3,397,855	\$5,359,384	\$12,132,215	\$50,634,045
UNWZ	2016	\$943,012	\$12,927,971	\$5,790,369	\$6,054,745	\$4,229,839	\$3,675,536	\$5,780,470	\$12,608,752	\$52,010,694
	2019	\$490,567	\$12,218,018	\$6,791,253	\$5,928,527	\$4,478,513	\$3,784,744	\$7,883,587	\$11,390,458	\$53,293,634
	2013	\$295,778	\$14,419,172	\$11,091,700	\$1,478,889	\$11,091,671	\$8,133,892	\$33,718,680	\$1,478,889	\$81,708,672
WMZ	2016	\$311,344	\$15,178,133	\$11,675,470	\$1,556,762	\$11,675,429	\$8,561,966	\$35,493,240	\$1,556,721	\$86,009,065
	2019	\$335,151	\$16,338,735	\$1,256,885	\$1,675,802	\$12,568,193	\$9,216,658	\$38,207,238	\$1,675,756	\$103,206,192
NZ	2019	\$998,749	\$5,201,369	\$7,583,004	\$5,728,962	\$16,243,471	\$6,099,169	\$7,852,719	\$929,852	\$39,020,125
	2013	\$12,176,688	\$113,888,442	\$43,749,508	\$128,049,080	\$70,461,655	\$70,949,784	\$204,386,368	\$63,080,209	\$706,741,735
Total	2016	\$12,930,090	\$109,814,206	\$190,795,784	\$139,083,254	\$82,467,947	\$64,268,327	\$206,623,095	\$92,228,949	\$898,211,651
	2019	\$15,394,193	\$135,653,774	\$236,682,729	\$163,911,959	\$119,863,780	\$81,172,054	\$232,449,994	\$105,873,161	\$1,099,137,007

SCI	FY	Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	93.00%	95.30%	94.90%	71_40%	99.30%	94.90%	61.30%	99.30%	90.10%
EMZ	2016	98.00%	97.97%	43.08%	63.86%	94.29%	93.86%	58.69%	92.07%	79.44%
and the set	2019	98.00%	97.97%	32.77%	56.30%	93.10%	92.89%	49.23%	90.26%	75.35%
-	2013	88.10%	98.50%	98.90%	90.60%	95.00%	97.10%	62.00%	99.90%	92.90%
GPZ	2016	98.00%	96.89%	91.10%	96.56%	99.10%	98.22%	91.99%	99.00%	96.39%
	2019	97.25%	96.58%	90.96%	96.19%	97.84%	98.21%	91.96%	99.00%	96.07%
	2013	95.90%	89.60%	96.90%	89.20%	94.30%	92.90%	81.80%	99.70%	93.10%
NMZ	2016	93.67%	92.59%	94.17%	89.23%	92.15%	92.84%	90.97%	99.00%	93.49%
	2019	93.66%	92.55%	94.16%	89.20%	92.15%	92.83%	90.92%	98.98%	93.47%
1.1.1.1	2013	60.00%	98.10%	87.60%	97.10%	97.20%	96.30%	84.30%	99.40%	93.90%
SAO	2016	60.01%	97.33%	97.96%	97.61%	96.07%	96.70%	82.89%	94.28%	94.45%
	2019	96.81%	91.39%	91.86%	86.86%	90.46%	92.70%	64.76%	92.39%	92.99%
	2013	95.20%	93.40%	97.80%	92.50%	97.10%	93.90%	89.80%	98.70%	94.90%
SERC	2016	87.27%	95.69%	99.22%	89.13%	98.20%	95.37%	95.99%	99.14%	95.87%
	2019	98.12%	95.82%	95.84%	92.78%	96.09%	95.03%	88.02%	95.38%	94.82%
1.1.1	2013	78.50%	75.50%	96.90%	67.60%	80.90%	71.30%	78.90%	90.50%	81.20%
SMZ	2016	74.08%	75.26%	92.44%	74.61%	86.87%	80.46%	72.24%	89.38%	82.33%
	2019	70.69%	74.05%	74.99%	73.44%	85.52%	79.20%	74.20%	89.01%	80.08%
	2013	97.50%	75.40%	68.40%	87.10%	86.60%	89.30%	57.70%	75.90%	76.60%
STRI	2016	95.77%	75.38%	83.77%	78.40%	84.41%	88.06%	63.06%	88.72%	82.45%
	2019	87.78%	70.82%	83.91%	75.90%	78.18%	84.92%	60.16%	90.90%	80.64%
	2013	97.50%	97.80%	97.60%	97.50%	98.90%	97.70%	65.60%	94.10%	93.20%
SUIT	2016	97.36%	97.77%	91.78%	97.51%	92.28%	97.71%	40.89%	92.37%	88.20%
Suitland	2019	96.61%	97.55%	91.40%	97.47%	91.95%	97.95%	66.40%	92.06%	91.26%
	2013	76.70%	83.50%	87.80%	86.00%	91.00%	91.80%	82.50%	91.40%	88.30%
UNWZ	2016	77.19%	83.43%	90.77%	86.00%	90.68%	91.64%	82.26%	91.65%	88.72%
	2019	89.39%	86.00%	90.18%	88.00%	91.40%	92.23%	78.30%	92.93%	89.58%
WMZ	2013	98.00%	87.00%	90.00%	98.00%	90.00%	90.00%	62.00%	99.00%	89.00%

Table 4 – System Condition Index (SCI) and Facilities Condition Index (FCI) by Zone

FY2019 Smithsonian Facility Condition Assessment Report

	2016	99.02%	93.65%	95.12%	99.02%	<mark>95.11%</mark>	95.11%	81.42%	99.51%	94.60%
	2019	98.82%	92.36%	99.41%	98.82%	94.12%	94.11%	77.64%	99.41%	92.75%
NZ (Z)	2019	92.76%	96.29%	92.68%	94.58%	85.72%	94.28%	90.52%	99.33%	95.15%
a programme and	2013	90.80%	89.10%	94.70%	83.10%	92.80%	89.60%	73.20%	95.70%	89.40%
Total	2016	91.91%	91.31%	83.29%	84.79%	93.02%	92.22%	75.97%	94.82%	88.95%
	2019	91.52%	90.53%	81.71%	84.26%	91.06%	91.22%	75.94%	94.69%	88.05%

FCI	> 95.0%	95.0 - 90.0%	6 < 90%
Condition	Good	Fair	Poor

Table 5 - Deferred Maintenance by Museum, Property, or Site

DM	FCI	FY19 CRV	FY19 Total DM Cost
AIB	63.4%	\$279,311,923	\$102,005,494
Anacostia	90.1%	\$11,479,132	\$1,130,694
CH-NJ	98.0%	\$12,051,705	\$241,034
CHSDM - Main,	91.5%	\$328,501,373	\$27,637,371
Freer	94.9%	\$257,833,753	\$12,917,471
Ft. Pierce, FL	88.2%	\$5,729,455	\$674,602
Garber-Suitland	92.5%	\$63,413,472	\$4,716,622
Herndon, VA	92.9%	\$22,472,840	\$1,577,593
Hirshhorn	81.2%	\$241,626,860	\$45,620,095
MSC-Suitland	87.0%	\$260,924,670	\$33,880,506
NASM-Dulles	85.7%	\$495,402,156	\$72,017,545
NASM-Dulles AP	88.9%	\$4,275,644	\$473,313
NASM-Mall	69.0%	\$902,583,876	\$279,375,228
National Postal	87.9%	\$38,621,617	\$4,638,456
National Museum of American History	87.8%	\$837,878,015	\$101,802,178
NMAAHC-Mall	97.7%	\$584,901,056	\$1,403,762

NMAI-CRC (Suit)	94.1%	\$52,720,280	\$3,076,548
NMAI-DC	96.3%	\$350,134,770	\$12,921,965
NMAI-NYC	91.5%	\$102,426,239	\$8,706,230
NMNH	93.4%	\$2,140,059,147	\$141,189,953
NZP-DC	89.2%	\$391,575,995	\$42,301,506
NZP-VA (SCBI)	90.8%	\$119,936,401	\$10,992,127
Quad	87.8%	\$513,761,293	\$62,628,826
Renwick	99.6%	\$56,277,311	\$219,481
Reynolds Center	96.3%	\$470,303,182	\$17,354,187
SAO-Arizona	90.2%	\$51,703,067	\$5,036,573
SAO-Hawaii	95.4%	\$58,478,255	\$2,687,867
SERC-Contee	92,4%	\$3,732,357	\$280,292
SERC-Corn Isla	-10.5%	\$1,763,255	\$1,948,993
SERC-Main	97.6%	\$69,237,774	\$1,602,797
SERC-Parkhurs	90.2%	\$566,047	\$55,484
SIB	62.1%	\$193,937,946	\$73,386,119
STRI-Ancon	66.7%	\$9,141,143	\$3,040,221
STRI-Barro Colo	83.1%	\$45,987,969	\$7,774,205
STRI-Bocas Del	90.1%	\$29,039,215	\$2,857,530
STRI-Clayton	86.0%	\$1,733,684	\$241,155
STRI-Coibita	20.5%	\$1,289,990	\$1,024,640
STRI-Culebra	89.7%	\$3,562,477	\$363,681
STRI-Galeta	86.3%	\$4,580,181	\$627,066
STRI-Gamboa	78.7%	\$56,822,699	\$12,068,338
STRI-Gigante	1.6%	\$2,188,917	\$2,153,372
STRI-Naos	83.3%	\$27,641,331	\$4,591,227
STRI-Parque Me	97.2%	\$368,508	\$10,002
STRI-Pina	89.3%	\$437,812	\$46,624
STRI-Sardinilla	97.2%	\$21,334	\$577
STRI-Tupper Co	78.7%	\$47,470,085	\$10,077,470
System Total			\$1,119,377,020

Table 6 - Museum DM Ranking from Lowest to Highest (FCI%)

Museums Rated Lowest to Highest %	FY19 FCI %	FY19 DM Cost
SIB	62.1%	\$73,386,119.06
AIB	63.5%	\$102,005,494.24
NASM-Mall	69.0%	\$279,375,228.77
Hirshhorn	81.2%	\$45,620,095.43
NASM-Dulles	85.7%	\$72,017,545.69
NMAH	87.8%	\$101,802,178.91
Quad	87.8%	\$62,628,826.98
Anacostia	90.1%	\$1,130,694.60
NMAI-NYC	91.5%	\$8,706,230.40
NMNH	93.4%	\$141,189,953.87
Freer	94.9%	\$12,917,471.07
Cooper-Hewitt NY	95.1%	\$16,020,200
NMAI-DC	96.3%	\$12,921,965.14
Reynolds Center	96.3%	\$17,354,187.44
Renwick	99.6%	\$219,481.51
NMAAHC-Mall	99.7%	\$1,403,762,.53
DM Ranking from Lowest to Highest		\$947,295,673.11

Figure 1 – FY19 Deferred Maintenance by Zone



Figure 2 – FY19 SCI % Per System



SCI System DM Dollar Value FY 2019

FY19 Total CRV \$9,195,377,850

Summary of Overall Condition

While the overall SI FCI is classified as poor with a score of 88%, five of the eight systems included in the rating are classified as being in fair condition. The structures themselves have the highest overall rating at 94.7%, with interior space at 92.1%. A closer look at the interior space reveals that the public spaces are in the good category, while non-public spaces staff spaces are generally considered to need repairs, bringing the overall rating to fair. Five of the eight systems saw improvement since the previous full assessment in FY16. This was due in large part to assessment increases resulting from the new construction projects, including the National Museum of African American History and Culture (2016) and the Hazy Module 1 Storage Facility (2019)

The roof condition, which continues to be the leading system in terms of financial need, can be attributed to factors that plague roofs in general and to specific conditions that we have within the Institution. SI buildings tend to have a high degree of complexity in design, where because of age or for architectural purposes, different materials were used in a wide variety of configurations – from metals to slate to built-up roofs to single-ply membranes. This means more required areas of connections, flashings, and height differentials, which adds to the aesthetics, but provides a multitude of opportunities for failure. The primary culprit had been the lack of maintenance over the years however SI has aggressively addressed preventive maintenance on roofs since 2007. Yet, due to the age of the majority of our facilities, previous access problems, and intricate details, many of the facilities have reached the failure point on the deterioration curve and SI is band-aiding problems which will continue to worsen until complete roof renovations are applied. The Roof Assessment and Preventive Maintenance Program was initiated twelve years ago and was intended to address these issues and the results can be seen by the increase in the SCI which was 60.4% in 2007. Since the reinstatement of the roofing program and having expanded it to include the entire building envelope, both for assessment and preventive maintenance, SI has been able to gain a very clear understanding of the major problem areas, as seen with the increase in DM&R from \$898.2M in FY16 to \$1.099B in FY19. Unchecked problems with the building envelope (including the roofing and exterior facades) are of utmost importance as they trigger a chain reaction including: deterioration of the structure and the interior façade and finishes, the inability to properly condition indoor spaces, and the risk to priceless collections as environmental intrusions occur causing gaps, leaks, and other failures.

HVAC remains in poor condition throughout most of the inventory. However, substantial improvements have been made since the initial survey in 2007 when the SCI was 79.5%. A system-wide point to point evaluation was implemented and is identifying issues and making recommendations for Capital and Maintenance projects. This retro-commissioning initiative is also improving the current systems performance and energy conservation. However, like roofs, our mechanical systems have suffered from years of underfunding and there is still a need for continued emphasis to maintain, repair, replace and upgrade this aging component of our critical facilities.

With a score of 83.1%, the poor condition of HVAC systems will have an adverse impact on collections and research. Proper and stable temperature and humidity control are essential to ensuring the microclimates required for the wide variety of collections (animate and inanimate) so as not to

accelerate degradation. Strict environmental control is also essential in the research facilities in order to prevent adverse impacts on experiments.

Vertical Transportation (i.e. Conveyances) has also remained relatively stable, with a score of 91.9% in FY16 and 91.5% in FY19. The Electrical system has degraded slightly but remains in good condition since the last full assessment from an SCI of 91.3% in 2016 to an SCI of 90.5% in 2019. Electrical issues are mostly age related with a significant number of medium and low voltage switchgear and panel boards requiring replacement due to obsolescence. SI continues to chip away at replacement of assets but with competing funding demands it has been a slow but steady process.

Plumbing systems, with a score of 91.2% for FY19, have the strongest correlation between age and functionality considering piping, valves, and pumps are all subject to chemical corrosion and flow induced erosion. While water chemistry issues have been largely rectified, the long-term effect is significant and has caused reduction in pipe wall thickness, loss of flow control due to poor valve performance, and reduced energy efficiency due to fouled heat transfer surfaces. In some cases, such as NASM and Garber, fire suppression piping is failing regularly due to bio-corrosion which is causing random pinhole leaks. Another major plumbing concern is at the Smithsonian Institution Building (The Castle). The system requires a complete overhaul as the removal of any portion risks causing failure at any other point in the system. Full replacement of the system is highly recommended. NOTE: The current renovation at the NASM building will vastly improve the overall Plumbing SCI in future assessment inspection reports.

Conclusions and Recommendations

- SI's overall FCI of 88.0% for FY19 remains in the poor category, with only a slight decrease from the FCI of 89.9% during the last full assessment in 2016.
- Efforts continue to incorporate assessment data as a basis for requirement prioritization into both maintenance/repair and capital revitalization decisions, and the subsequent plans and programs.
- There is a need to better utilize the FCA process in the identification of specific projects throughout SI. We are adopting a supplemental Knowledge Based Assessment approach that can better link conditions to specific requirements and assets, working to standardize an asset level condition program, and incorporating this with the Facility Requirements Database (FReD) in Facilities Center.
- Efforts to expand communication between the Maintenance teams and the Capital Planning teams should continue as synergy between what is designed into our facilities and maintaining the systems is vital to our continued success at meeting the Smithsonian's mission.

As we continue to face the challenge of limited funding for both Capital and Maintenance, we must allocate our limited resources to the facilities and systems that are critical to our mission and have the most urgent needs. It is essential that this assessment data be used in the annual budget request that is presented to Congress.

Zone/Area Assessments

The discussion below highlights some of the many issues addressed over a three-year period that pertain to key facilities in each zone/area. This includes a full list of buildings, with their CRV, DM and FCI for FY13, 16, and 19.

South Mall Zone

The South Mall Zone is comprised of five facilities consisting of seven (7) museums. As a full campus, the South Mall Zone equates to eleven (11) buildings and structures, and the Hishhorn Sculpture Garden. There are multiple known issues that continue to plague the South Mall Zone and will continue to do so until monies for revitalization become available. Some overarching issues in the zone include concerns with the steam generation transfer system from GSA and (b) (7)(E)

Number	Name		CRV	DM&R	FCI
		2013	\$1,136,257,874	\$213,698,933	82.2%
SMZ	Entire South Mall Campus	2016	\$1,190,556,504	\$210,350,650	82.3%
		2019	\$1,488,790,018	\$296,558,007	80.0%
	and the second	2013	\$441,927,498	DM&R \$213,698,933 \$210,350,650 \$296,558,007 \$37,519,645 \$56,707,027 \$62,627,501 \$96,853,133 \$64,616,321 \$102,005,494 \$111,147,708 \$9,358,857 \$12,917,471 \$22,490,894 \$23,755,260 \$45,620,095 \$45,609,043 \$55,911,185	91.5%
091-001	Quadrangle	2016	\$465,199,485	\$56,707,027	87.8%
-		2019	\$513,761,293	DM&R \$213,698,933 \$210,350,650 \$296,558,007 \$37,519,645 \$56,707,027 \$62,627,501 \$96,853,133 \$64,616,321 \$102,005,494 \$11,147,708 \$9,358,857 \$12,917,471 \$22,490,894 \$23,755,260 \$45,620,095 \$45,609,043 \$55,911,185 \$73,386,119	87.8%
	Cost a character	2013	\$166,385,729	\$96,853,133	41.8%
151-001	Arts & Industries Building	2016	\$176,959,140	\$64,616,321	63.5%
		2019	\$279,610,258	\$213,698,933 \$210,350,650 \$296,558,007 \$37,519,645 \$56,707,027 \$62,627,501 \$96,853,133 \$64,616,321 \$102,005,494 \$11,147,708 \$9,358,857 \$12,917,471 \$22,490,894 \$23,755,260 \$45,620,095 \$45,609,043 \$55,911,185 \$73,386,119	63.5%
		2013	\$184,564,697	DM&R \$213,698,933 \$210,350,650 \$296,558,007 \$37,519,645 \$56,707,027 \$62,627,501 \$96,853,133 \$64,616,321 \$102,005,494 \$11,147,708 \$9,358,857 \$12,917,471 \$22,490,894 \$23,755,260 \$45,620,095 \$45,609,043 \$55,911,185 \$73,386,119	94.0%
181-001	Freer Gallery of Art	2016	\$186,803,526		95.0%
		2019	\$257,833,753	\$12,917,471	94.9%
	the second second	2013	\$175,435,990	\$22,490,894	87.2%
211-001	Hirshhorn Museum & Sculpture Garden	2016	\$185,993,898	\$23,755,260	87.2%
		2019	\$243,628,734	\$45,620,095	81.2%
	· To date the	2013	\$166,821,663	\$45,609,043	72.7%
241-001	Smithsonian Institution Building	2016	\$175,600,456	\$55,911,185	68.2%
		2019	\$193,937,946	\$73,386,119	62.1%

Quadrangle

- National Museum of African Art
- Arthur M. Sackler Gallery
- Ripley International Center

The Quad is a unique architecture and resides mostly below ground, with the Enid A. Haupt garden being located directly over it. This creates foreseeable challenges often found in green roofing systems with maintaining a leak-proof envelope. The garden is leaking in multiple locations and the moisture barrier and joint seals have reached the end of their lifecycles and require a full replacement. Other known issues at the quad include outdated electrical panels, vertical transportation that needs to be updated, and difficulties with sewer and storm drain systems.

Freer Gallery of Art

The Freer underwent a relatively large-scale humidification project in 2016 and 2017. Smithsonian Facilities was able to utilize the opportunity to tackle multiple other issues including upgrades to its envelope, and vertical transportation. In 2018 a project was completed on the roofing system to replace the flashings, scuppers, and gutters, to ensure continued longevity.





Arts and Industries Building

The buildings current use is in support of limited occupancy or special events venue including the four halls and the rotunda. In FY18 a project was completed to get the loading dock operational once again making these functions more feasible.



Hirshhorn Museum and Sculpture Garden

Major known issues in the Hirshhorn Building include leaking of the envelope, exacerbated by improper drainage at exterior concrete platforms, conveyance concerns with both the elevator and escalator, and hazardous roof leaks that pose the possibility of contributing to a roof failure if not addressed by replacement rather than minor repairs. Short and long-term strategies to address all these issues are in the Master Plan and should remain a high priority.



Smithsonian Institution Building

The SI building remains in poor condition and needs a major Capital Renovation Project in the future. A full assessment, down to the asset level, was performed in FY2014 reconfirming the need for a complete revitalization project. There is a design project called major revitalization for SI (castle) is in design phase, construction for this project is projected to start in FY22/23. It should be noted that certain systems including the mechanical piping is in an extremely deteriorated state. At this juncture the SF team is concerned that attempting partial fixes could cause further unintended and catastrophic consequences at other points within the line. There is a current risk of damage to collections that remain in the facility until the system is completely renovated.



Zone Comparison from previous Assessments

SCI		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	78.50%	75.50%	96.90%	67.60%	80.90%	71.30%	78.90%	90.50%	81.20%
SMZ	2016	74.08%	75.26%	92.44%	74.61%	86.87%	80.46%	72.24%	89.38%	82.33%
	2019	70.69%	74.05%	74.99%	73.44%	85.52%	79.20%	74.20%	89.01%	80.08%

West Mall Zone (WMZ)

The West Mall Zone is comprised of two main facilities, the National Museum of American History and the National Museum of African American History and Culture. During the desk audit in 2018 it was discovered that the CRV of NMAAHC was higher than expected due to the differential between rentable and gross square footages. The number was adjusted and the lower zone FCI in FY18 reflects the change in the weighting of the newer building.

Number	Name		CRV	DM&R	FCI
		2013	\$740,824,359	\$81,708,672	89.0%
WMZ	West Mall Zone Campus	2016	\$1,592,971,992	\$86,009,005	94.6%
		2019	\$1,424,456,483	\$81,274,418	92.7%
		2013	\$739,444,734	DM&R \$81,708,672 \$86,009,005 \$81,274,418 \$81,708,643 \$86,009,065 \$101,802,178 N/A \$0 \$1,403,762	89.0%
031-001	National Museum of American History	2016	\$779,812,777	\$86,009,065	89.0%
		2019	\$837,878,015	\$101,802,178	87.8%
		2013	N/A	N/A	N/A
271-001	National Museum of African American History and	2016	\$813,159,215	\$0	100%
	Guiture	2019	\$584,974,561	\$1,403,762	99.7%

National Museum of American History - Behring Center

In FY18, the museum's front entry doors were replaced, and an approximately \$10,000 roof replacement project is ongoing with expected completion in 2019. In FY18 a design project was also awarded to review the entire HVAC system of the facility to help tackle ongoing humidification concerns, with planned replacements from the findings to begin in 2021. In 2016, the PSRP III project renewed the three public floors, including the replacement of two zones of the HVAC system, electrical distribution system, fire detection and alarm system, life safety egress paths, and the fire protection system, of the museum's west wing. There is a PSRP IV project planned to accomplish the same for the east wing, but due to funding constraints it is being broken out into sections with planned revitalization of the east wing elevators and escalators in 2020. NMAH is also scheduled to receive an upgrade to the fire alarm and mass notification systems and a capital improvement project to fix issues with the grease ventilation system in FY20.



National Museum of African American History and Culture

The newest museum on the National Mall was opened to the public on September 24th, 2016. Currently, there is very little deferred maintenance considerations for the newer facility, the systems require ongoing maintenance to keep them functioning properly.



Zone Comparison from previous Assessments

SCI	122	Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	201 3	98.00%	87.00%	90.00%	98.00%	90.00%	90.00%	62.00%	99.00%	89.00%
WMZ	201 6	99.02%	93.65%	95.12%	99.02%	95.11%	95.11%	81.42%	99.51%	94.60%
	201 9	98.82%	92.36%	99.41%	98.82%	94.12%	94.11%	77.64%	99.41%	92.75%

North Mall Zone (NMZ)

The North Mall Zone consists of the National Museum of Natural History (NMNH), which is Smithsonian's largest facility, it is assessed as six buildings, reflecting the history of the facility and how it evolved over time. The six buildings are: Main Museum Building; East Wing; West Wing; East and West courtyard in-fills; and central mechanical plant. This facility rating also includes four guard booths and an OPDC construction trailer. Due to the differing ages of each facility, they are rated separately, and compiled into an overall facility rating.

Number	Name	College States	CRV	DM&R	FCI
		2013	\$1,439,764,101	\$98,868,518	93.1%
NMZ	North Mail Zone Campus	2016	\$1,713,316,194	\$111,525,854	93.5%
		2019	\$2,172,083,859	DM&R \$98,868,518 \$111,525,854 \$141,857,847 \$98,268,188 \$111,279,735 \$141,189,953 \$279,850 \$243,040 \$674,602	93.4%
		2013	\$1,416,908,225	\$98,268,188	93.1%
001-001	National Museum of Natural History	2016	\$1,708,359,848	\$111,279,735	93.5%
1		2019	\$2,166,630,348	DM&R \$98,868,518 \$111,525,854 \$141,857,847 \$98,268,188 \$111,279,735 \$141,189,953 \$279,850 \$243,040 \$674,602	93.48%
		2013	\$4,499,824	\$279,850	93.8%
953-001	Ft Pierce Campus	2016	\$4,736,106	\$243,040	94.9%
		2019	\$5,729,455	\$674,602	88.2%

National Museum of Natural History

In FY18 a new fire pump was installed in the SE quadrant, and multiple improvements were made to the steam system including replacement of a main steam valve and the west wing steam station heating and hot water pump, totaling about \$60k, as well as the elimination of the low pressure steam leg which was replaced with 2-80 gallon hot water heaters – a \$70k project resulting in a \$40k annual estimated utility cost savings. The condenser water pumps 12 and 13 were replaced through a \$260k maintenance project, and 3 secondary chilled water pumps and their motors were replaced with a maintenance project cost of \$360,000.

The museum is also currently undergoing two major capital projects that are focused on improving visitor experience with expected completion in FY19. The south side entrance is being renovated to provide new accessibility, but the project includes cleaning the exterior south side facade. The west court interior upgrade project includes a revitalization of the elevator, roof repair for the leaking skylights, new hot water heaters for the kitchen.

In FY19 the chiller plant adaptive control panels will be replaced at an expected maintenance cost \$115k, and 10-year overhauls will occur on chillers 5 and 1 for approximately \$150k. The north lobby will receive a new HVAC system with chilled water and fan coil units for the OPS office. There is also a plan to replace the steam condensate line from the tunnel entrance to the steam station at the SE quad.

In FY20 there are capital projects programmed to upgrade the electrical system as well as the mass notification system and replace (b)(7)(F) throughout the building.

Despite minor Capital Program upgrades to the building's east and west wings facility systems the following ongoing concerns for the museum persist: roofing, the drainage is undersized, the metal gutters/flashing leak, and the rotunda roof is past its lifecycle; HVAC, system upgrades are required for assets past their lifecycle and the chillers need to be replaced; Exterior, window repairs are needed; vertical transportation assets require complete revitalization; plumbing, the sanitary sewer and domestic water lines are both past their lifecycle and require replacement as failures have already begun to occur; interior, lead abatement and painting are required, failing floors are causing tripping hazards, and a majority of the restrooms have not been upgraded for decades.



Fort Pierce, Florida Campus

This campus includes six buildings and multiple structures. The Marine Research Laboratory facilities at Ft. Pierce have had a major increase from the FY 2010 assessment and previous major deficiencies that were in the mechanical systems have been repaired or replaced in the main laboratory through a major maintenance project.

In FY17 the Tyson house underwent a \$100k project that replaced the deck, siding, windows, doors, and exterior plumbing. Hurricane Irma hit the Southeastern United States in September of 2017 and the Ft. Pierce dock and the transformer that is providing shore power were affected. In FY18, hurricane specific relief funding was provided to repair both items. In FY19 a maintenance project to repair and paint the main roof at a projected cost of \$60k is scheduled. During the last physical site assessment in FY19, the following deficiencies were noted:

- Exhaust fans need to be replaced.
- Condensation issues in main lab.
- Floors need to be replaced.
- Mechanical needs such as insulation, pipes, and air vacuum pumps need to be replaced.



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SCI		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	95.9%	89.6%	96.9%	89.2%	94.3%	92.9%	81.8%	99.7%	93.1%
NMZ	2016	93.6%	92.5%	94.1%	89.2%	92.1%	92.8%	90.9%	99.0%	93.4%
	2019	93.6%	92.5%	94.1%	89.2%	92.1%	92.8%	90.9%	98.9%	93.4%

Zone Comparison from previous Assessments

East Mall Zone (EMZ)

The East Mall Zone is comprised of four facility groupings:

- National Air and Space Museum(National Mall)
- Udvar-Hazy Center (Dulles, VA)
- Spring Park I 380 Herndon Parkway.

Altogether there are 18 buildings and structures within the East Mall Zone maintenance responsibility.

Number	Name	0.000	CRV	DM&R	FCI		
		2013	\$1,052,860,366	\$145,035,011	90.1%		
EMZ	East Mall Zone	2016	\$1,560,422,078	\$320,887,081	79.4%		
1		2019	\$1,433,938,406	\$353,515,595	75.3%		
an and a little	and the second second	2013	\$658,698,239	\$91,069,418	86.2%		
061-001	National Air & Space Museum	2016	\$801,951,436	\$248,172,899	69.0%		
		2019	\$902,991,041	\$279,375,228	69.0%		
		2013	\$380,319,998	\$380,319,998 \$37,840,995			
545-001	Udvar-Hazy Center	2016	\$413,178,871	\$59,428,097	85.6%		
		2019	\$504,198,879	\$72,017,545	85.7%		
		2013	\$6,040,836	\$163,103	97.3%		
681-001	380 Herndon-Spring Park I	2016	\$6,383,676	\$114,906	98.2%		
		2019	\$22,472,840	\$1,649,506	92.6%		

National Air & Space Museum (NASM)

Note: This building is currently undergoing a major renovation while remaining open to the public.

Significant deficiencies rest within the building envelope and HVAC system. Both require extensive overhauls. The Tennessee marble stone façade was found to have irreversible damage showing cupping and visible cracks. Stone forensic test findings revealed thermal hysteresis and moisture in the unusually thin stone likely causing the failure. Due to these failures, NASM will be undergoing a major renovation that will tackle issues with multiple systems including a complete roof replacement, HVAC upgrades with new boilers and chillers, electrical component upgrades, partial vertical transportation revitalization, and other various upgrades phased over the next 7 years.



Udvar-Hazy

The assessment of Udvar-Hazy includes an additional eight buildings such as toll booths and storage buildings. The main deficiency is the failing roof system and is currently in its design phase with a planned construction project awarded in FY18. Repairs are being performed on an as needed basis to keep the facility open to the public. Other large maintenance concerns include the need to repair the parking lot and road, the ADA ramp retaining wall, an overhaul of the chiller, replacement of coils, replacement of the switchgear in the main building and generator replacements due to age. The new storage facility was constructed during FY18 at Udvar-Hazy.



380 Herndon Parkway

This leased facility houses SI's data center for OCIO. SI is responsible for maintenance and repair on all systems except the structure, and exterior. SI had an audit conducted in FY18 and received recommendations for upgrades to the (b) (5)

that affect the continued feasibility of this facility to support its OCIO mission.





Zone Comparison from previous Assessments

SCI	FY	Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	93.00 %	95.30%	94.90%	71.40%	99.30%	94.90%	61.30%	99.30%	90.10%
EMZ	2016	98.00 %	97.97%	43.08%	63.86%	94.29%	93.86%	58.69%	92.07%	79.44%
100	2019	98.00 %	97.97%	32.77%	56.30%	93.10%	92.89%	49.23%	90.26%	75.35%

FY2019 Smithsonian Facility Condition Assessment Report

Suitland Zone

The Suitland Zone comprised of four facilities (or facility groupings):

- Cultural Resource Center for the American Indian Museum (CRC).
- SI Gardens Greenhouses
- Garber Facilities
- Museum Support Center (MSC)

Number	Name		CRV	DM&R	FCI
	10. Tr	2013	\$329,508,305	\$22,278,771	93.2%
SUIT	Suitland Zone	2016	\$349,535,310	\$41,259,559	88.2%
		2019	\$377,152,996	\$32,967,411	91.26%
		2013	\$214,338,386	\$16,332,585	92.4%
301-001	Museum Support Center	2016	\$233,045,622	\$33,484,800	85.6%
		2019	\$260,924,670	\$25,174,240	90.3%
1.000	HSD Greenhouse	2013	\$4,453,635	\$0	100.0%
301-008		2016	\$4,688,414	\$24,380	99.5%
		2019	\$5,177,538	\$44,526	99.1%
		2013	\$51,639,683	\$2,542,994	95.1%
455	Garber Campus	2016	\$56,817,806	\$4,213,518	92.6%
		2019	\$63,413,472	\$4,716,622	92.5%
	the stand of the	2013	\$46,634,879	\$2,714,150	94.2%
515-001	NMAI Cultural Resource Center	2016	\$49,173,048	\$2,858,172	94.2%
		2019	\$52,814,853	\$3,076,548	94.1%

Cultural Resource Center for the American Indian Museum (CRC)

Consistent minor roof repairs continue to be required to bridge larger deficiencies, but replacement of a major portion of the roof is urgent as the roof has become an issue in every rain event. The larger repair must be addressed to protect collections. The front hardscape including the water feature needs capital renewal. The emergency generator and switchgear are undergoing a large capital revitalization project which is in the design phase with planned construction award in FY 20/21.


Garber Facility

The Garber Facility is a collection of metal pre-engineered buildings used as collection storage for NASM, NMAH, NMNH, and vehicle operational and maintenance facilities. The buildings are aging but can serve the intended purpose of storage and shop space. Buildings 5, 8, 12, 13, 16, 18, 27, and 34 are in the poorest condition. Not currently considered in the FCI are lingering asbestos containing materials (ACM) concerns impacting SIs ability to maintain and properly operate within these facilities. Other concerns are possible failure due to snow loads and continued deterioration of the buildings affecting their ability to properly protect collections. Design to replace all (b) (7)(F) for Garber facility was completed in FY19 with anticipated construction in FY21.



Museum Support Center (MSC)

The Museum Support Center (MSC) serves primarily as a collection storage and laboratory research space supporting the Natural History Museum but includes the Osteo-Prep Laboratory. Design was completed and the construction project begun on the roof replacements on pods 1, 2, 4, and 5. The Osteo-Prep Lab roof also requires replacement. There is an on-going large capital project planned to replace the AHUs in laboratories 1-4 as they are beyond their lifecycle. The design phase was completed in the beginning of FY18 and the construction phase slotted for FY20-21. Upcoming projects to renovate the laboratory portion of the building will also help to improve the overall condition of the facility.



Smithsonian Garden Greenhouses

The greenhouse has issues with cladding and fall protection that need to be addressed for it to continue serving its function.



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SCI		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	97.50 %	97.80%	97.60%	97. <mark>50%</mark>	98.90%	97.70%	65.60%	94.10%	93.20%
SUIT Suitland	2016	97.36 %	97.77%	91.78%	97.51%	92.28%	97.71%	40.89%	92.37%	88.20%
	2019	96.61 %	97.55%	91.40%	97.47%	91.95%	97.95%	66.40%	92.06%	91.26%

Zone Comparison from previous Assessments

Upper Northwest Zone (UNWZ)

The Upper Northwest Zone is comprised of two groups of facilities.

- National Zoological Park
- Smithsonian Conservation Biology Institute (SCBI) Front Royal, VA

The sum of buildings and structures for both sites are 307.

Number	Name		CRV	DM&R	FCI
100		2013	\$433,072,217	\$50,634,045	88.3%
UNWZ	Upper Northwest Zone	2016	\$461,204,062	\$52,010,694	88.7%
100 M		2019	\$511,512,397	\$53,293,634	89.6%
	and the local sector	2013	\$329,599,647	\$42,729,442	87.0%
331	National Zoological Park Campus	2016	\$344,357,892	\$39,461,845	88.5%
		2019	\$391,575,995	\$42,301,506	89.2%
		2013	\$103,301,943	\$7,904,603	92.4%
701	NZP - SCBI Campus	2016	\$107,084,993	\$8,043,418	92.5%
· · · · · · · · · · · · · · · · · · ·		2019	\$119,936,401	\$10,992,127	90.8%

Smithsonian National Zoological Park:

All significant facilities at the zoo have a low FCI score, including the General Services Building, Reptile Discovery Center, Small Mammal House, Think Tank, Upper and Lower Bear, Lion and Tiger, Amazonia, and the Great Ape House. These facilities represent a major portion of the NZP CRV and have a high impact on its overall rating.

NZP continues to struggle with issues related to aging infrastructure that effect all aspects from steam lines to exterior fences. The overall FCI continues to fall in the poor category with roofing, electrical, and HVAC being in the poorest conditions. A large steam tunnel project was begun in FY18 using a combination of in-house workforce and contractors with completion planned for FY19. Although this project will help improve the HVAC SCI, roofing, HVAC, electrical and plumbing have consistently scored in the "Poor" range, and revitalization of these systems must continue. The Bird House is currently in the construction phase of a Capital Project and the concerning structural condition of the General Services Building underwent major repair under the Capital Program in FY19. Elevators in the General Services Building and Amazonia were upgraded in FY18.



Smithsonian Conservation Biology Institute - Front Royal

SCBI also held steady with an FCI score that dropped from 92.2% in FY17 to 90.0% in FY19. SI continues to tackle the roofing system with roof and gutter maintenance projects. Several the facilities are in fair to poor condition, but their low CRV does not greatly impact the overall FCI due to their small footprint compared with larger facilities on the property.



Zone Comparison from previous Assessments

SCI	FY	Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	76.70%	83.50%	87.80%	86.00%	91.00%	91.80%	82.50%	91.40%	88.30%
UNWZ	2016	77.19%	83.43%	90.77%	86.00%	90.68%	91.64%	82.26%	91.65%	88.72%
	2019	89.39%	86.00%	90.18%	88.00%	91.40%	92.23%	78.30%	92.93%	89.58%

Gallery Place Zone (GPZ)

The Gallery Place Zone is comprised of:

- Donald W Reynolds Center
- The Renwick Gallery
- The National Postal Museum
- Victor Building (Leased)

Number	Name	The second second	CRV	DM&R	FCI
		2013	\$484,032,577	\$34,387,626	92.9%
GPZ	Gallery Place Zone	2016	\$509,612,471	\$18,400,755	96.3%
1.00		2019	\$565,202,111	\$22,212,125	96.0%
1000	a la seconda de la companya de la co	2013	\$407,219,805	\$21,338,318	94.8%
485-001	D. W. Reynolds Center	2016	\$428,649,510	\$15,817,167	96.3%
		2019	\$470,303,182	\$17,354,187	96.3%

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1.2.2.2	and the second	2013	\$50,460,609	\$11,681,631	76.9%
575-001	Renwick Gallery	2016	\$53,115,913	\$127,478	99.8%
		2019	\$56,277,311	\$219,481	99.6%
Sec. 2	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	2013	\$26,352,164	\$1,367,677	94.8%
678-001	National Postal Museum	2016	\$27,847,048	\$2,456,110	91.1%
_		2019	\$38,621,617	\$4,638,456	87.9%
821-000	SERC-Main	2019	\$69,237,774	\$1,602,797	97.6%
		1.00			

Donald W. Reynolds Center (Old Patent Office Building)

This facility went through a major renovation and continues to be well-maintained and in good condition. DWRC received good ratings on all building systems except the exterior which rated as fair. A maintenance project to caulk parts of the exterior to help seal the envelope was conducted in FY18, but concerns remain about the (b)(7)(F) making conditioning the space, keeping leaks at bay, stopping condensation issues, and protecting the collections more difficult.



Renwick Gallery

The complete renovation of this building was completed in FY16. The building continues to score in the excellent category.



National Postal Museum

This is a GSA owned building; however, SI has maintenance responsibility for the portion that houses the Postal Museum. SI is responsible for the HVAC, electrical, conveyance, and interior systems.

The HVAC and electrical systems are at or near the end of their expected life cycles, which contributed to the total FCI decreasing to poor condition. The conveyance and interior systems are in good condition.



Smithsonian Environmental Research Center (SERC)

SERC in Edgewater, MD is largely composed of smaller, less expensive buildings dedicated to research and education with few spaces open to the public. Currently this facility is valued at over \$43 million. Currently there are maintenance issues with roofs, gutters, and fall protection.



The SERC campus is comprised of 55 building with a total CRV of \$69,237,774. As such the overall facility condition rating also saw a small bump up from 95.87% in 2016 to 97.6% in 2019. It is important to note that although the other facilities are small, they need attention especially with HVAC, roofs, and generators.

Zone Comparison from previous Assessments

SCI	FY	Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
	2013	88.10%	98.50%	98.90%	90.60%	95.00%	97.10%	62.00%	99.90%	92,90%
GPZ	2016	98.00%	96.89%	91.10%	96.56%	99.10%	98.22%	91.99%	99.00%	96.39%
	2019	97.25%	96.58%	90.96%	96.19%	97.84%	98.21%	91.96%	99.00%	96.07%

Number	Name	FY	CRV	DM&R	FCI
NEW ZONE		2019	\$804,664,369	\$39,020,125	95.1%
1.1		2013	\$449,419,870	\$15,460,044	96.60%
121-001	National Museum of the American Indian	2016	\$317,108,225	\$11,700,720	96.30%
		2019	\$350,205,917	\$12,921,965	96.30%
		2013	\$226,093,441	\$5,011,600	97.8%
811	Cooper-Hewitt NY	2016	\$297,437,697	\$6,142,170	97.9%
		2019	\$328,501,373	\$16,020,200	95.1%
6.777		2013	\$88,105,163	\$10,192,413	88.4%
956-001	Alexander Hamilton US Custom House	2016	\$92,743,425	10,943,724	88.2%
		2019	\$102,426,239	\$8,706,230	91.5%
100		2013	\$9,873,969	\$631,934	93.6%
585-001	Anacostia Museum	2016	\$10,393,723	\$696,379	93.3%
		2019	\$11,479,132	\$1,130,694	90.1%

New Zone

National Museum of the American Indian

The National Museum of the American Indian is still in relatively new condition. There has been some concern about chemical reactions causing staining on the building exterior and methods are being researched to ensure no long-term effects. The nuisance of excessive algae blooms in the extensive water feature was tackled with appropriate water treatment methods. SI continues to tackle energy efficient programming concerns with the chiller. Overall, the NMAI facility remains in good condition.



The Cooper-Hewitt/Miller Fox Museum

The museum is currently valued at \$328M and is also assessed as separate museums that share building systems. Both buildings underwent major capital renovations recently. The chillers and cooling towers were replaced. A project is in design phase to upgrade the emergency generator.

Alexander Hamilton U. S. Customs House

The structure is occupied and maintained by SI and has a CRV of \$102M. This property is owned and primarily maintained by GSA. However, SI has responsibility for the HVAC, electrical, interior and plumbing systems dedicated to the SI leased space (272,700 GSF). Therefore, the \$93M CRV represents the portion of the total CRV that these four systems would receive, which is 25% of the total CRV that the occupied GSF would generate. Chillers were replaced in FY20.

New York:



Anacostia Community Museum

The Anacostia Community Museum located in Southwest DC is a community cultural center. Required maintenance includes replacing the electrical wiring and lighting, replacing the loading dock, replacing (b) (7)(F), roof replacement, and HVAC replacement. This museum is currently being renovated.



SCI		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
NZ	2013	95.20%	93.40%	97.80%	92.50%	97.10%	93.90%	89.80%	98.70%	94.90%
(Zone)	2016	87.27%	95.69%	99.22%	89.13%	98.20%	95.37%	95.99%	99.14%	95.87%
	2019	92.76%	96.29%	92.68%	94.58%	85.72%	94.28%	90.52%	99.33%	95.1%

Smithsonian Astrophysical Observatory (SAO) Zone:

The SAO has facilities located at the Fred L. Whipple Observatory: Mt. Hopkins, Arizona, the Sub Millimeter Array (SMA): Mauna Kea Hawai'i, and at Harvard University in Cambridge, MA. OFMR provides funding for maintenance for the Arizona and Hawaii sites.

Number	Name	(CRV	DM&R	FCI
SAO Zone		2019	\$110,181,323	\$7,724,440	92.9%
		2013	\$18,368,082	\$151,780	99.2%
837	SAO - HI Site	2016	\$18,798,966	\$360,694	94.1%
	Sub-Millimeter Array	2019	\$58,478,255	\$2,687,867	95.4%
	And a second	2013	\$63,317,947	\$4,198,618	93.9%
838	SAO - AZ site	2016	\$47,264,799	\$2,728,181	94.4%
	I Ted L. Milippie Observatory	2019	\$51,703,067	\$5,036,573	90.2%

Fred L. Whipple Observatory

At the Arizona site, 51 buildings and structures are assessed. Many facilities show aging and the harsh environment has caused the exterior and roofing ratings to drop. There is a roof repair project scheduled with expected construction at the beginning of FY19. Overall, the buildings are in good condition and we must manage with an extremely limited maintenance budget at these facilities.



Submillimeter Array (SMA)

During the last physical site assessment in FY19 the condition of the facilities surveyed was excellent despite climatic factors in Hilo that would accelerate damage and deterioration (140 inches of rainfall, harsh winds, and large temperature variations on top of the mountain). The overall condition of the facilities appears to be good. Within this assessment are three buildings and four structures.



Base Camp: This building is in relatively good condition. The following deficiencies were discovered during the site visit:

- Has four HVAC units, with one near its' life expectancy.
- Roof leak in front of the Main Building.
- Exterior lights should be replaced with LED light fixtures and poles lights.
- Interior floors in need of repairs in areas.

Mountain Campus: The following deficiencies were discovered during the site visit:

- Main Hanger roof needs repair and should be replaced.
- Roof needs fall protection.
- Windows need to be sealed (leaking).
- Exterior building panels in need of repair in areas.
- There are (3) small HVAC split system units at or near life expectancy.
- The main switch gear is also at or very near its' life expectancy.

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Zone Comparison from previous Assessments

SCI		Convey	Electrical	Exterior	HVAC	Interior	Plumbing	Roofing	Structure	FCI
SAO	2013	60.0%	98.1%	87.6%	97.1%	97.2%	96.3%	84.3%	99.4%	93.9%
(Arizon a)	2016	60.0%	97.3%	97.9%	97.6%	96.0%	96.7%	82.8%	94.2%	94.4%
	2019	96.8%	91.3%	91.8%	86.8%	90.4%	92.7%	64.7%	92.3%	92.9%

Smithsonian Tropical Research Institute (STRI)

The STRI region has an inventory of over 199 buildings and structures. Another physical site assessment is scheduled for FY19.



Number	Name	FY	CRV	DM&R	FCI
		2013	\$164,570,367	\$38,484,765	76.6%
STRI	Smithsonian Tropical Research Institute	2016	\$190,978,664	\$33,508,338	82.5%
		2019	\$231,820,507	\$44,876,114	80.6%
		2013	\$1,772,158	\$1,618,397	8.7%
789	Gigante	2016	\$699,314	\$158,606	77.3%
		2019	\$2,188,917	\$2,153,372	1.62%
1		2013	\$38,058,467	\$7,460,274	80.4%
792	Tupper Complex	2016	\$42,971,188	\$8,685,753	80.0%
		2019	\$47,470,085	\$10,077,470	78.7%
		2013	\$5,067	\$1,666	67,1%
793	Parque Metro	2016	\$5,332	\$250	95.3%
		2019	\$368,508	\$10,002	97.2%
		2013	\$40,355,700	\$6,030,257	85.1%
794	Barro Colorado Island	2016	\$42,609,677	\$3,546,518	91.7%
		2019	\$45,987,969	\$7,774,205	83.1%
		2013	\$23,478,350	\$3,488,903	85.1%
795	Naos	2016	\$23,807,077	\$3,387,553	85.8%
		2019	\$27,641,331	\$4,591,227	83.3%
- 1. Jan 1.	The second second	2013	\$376,598	\$170,467	54.7%
796	Ft. Sherman (Pina)	2016	\$39,641,483	\$0	100%
		2019	\$437,812	\$46,624	89.3%
707	Colute	2013	\$3,673,770	\$3,105,017	15.5%
191	Galeta	2016	\$3,894,193	\$1,880,010	51.7%

		2019	\$4,580,181	\$627,066	86.3%
		2013	\$7,897,565	\$790,056	90.0%
798	Ancon	2016	\$8,313,104	\$2,525,164	69.6%
12.21 June		2019	\$9,141,143	\$3,040,221	66.7%
		2013	\$2,820,479	\$464,069	83.5%
799	Culebra	2016	\$2,968,920	\$245,810	91.7%
		2019	\$3,562,477	\$363,681	89.7%
Number	Name	FY	CRV	DM&R	FCI
		2013	\$22,157,213	\$14,266,298	35.6%
800	Gamboa	2016	\$27,375,766	\$6,194,331	77.4%
		2019	\$56,822,699	\$12,068,338	78.7%
		2013	\$24,136,541	\$970,836	96.0%
801	Bocas del Toro	2016	\$25,979,947	\$1,511,882	94.2%
		2019	\$29,039,215	\$2,857,530	90.1%

Factors contributing to the changes in the above values include new construction, major repairs to existing facilities, improved maintenance practices, and the hiring of better contractors. The Panama City area facilities/buildings are still in the best overall condition when compared to facilities in the more remote areas of the region. The lack of resources and harsh environmental conditions in the remote areas remains the greatest detriment to the conditions of the facilities overall.

Overall Building/Facility Problems in remote areas:

- Termites
- Roofs tiles (heat and wind)
- Water causing electrical damage (improper use of electrical devices)
- Age and upkeep of structures (decaying and abandoned) buildings
- Maintenance practices are not up to current code

Roofing

- Laboratory/Visitor's Center at Galeta the observation tower has been repaired, but the roof is still in need of repairs.
- Conference Center/Archives Library at Tupper, High-Rise Laboratory buildings at Naos, and the Laboratory at Tupper- Still need roof repairs.

Electrical

- Overall lack of code compliance
- Overall lack of basic electrical principles

Mechanical

Recommend going with one manufacturer using the network in place as the backbone. This
would be cost effective from an energy management standpoint. This mechanical monitoring
upgrade should be phased starting with the lager buildings at Tupper center, Naos and some of
the lab areas.

Individual Building Calculations FY19 CRV, DM, and FCI

FCI from 89.9% and Below	
FCI from 90 to 94.9%	
FCI from 95 to 100%	

ID	Building	CRV	DM	FCI
001-001	National Museum of Natural History	\$2,140,059,147.74	\$139,852,865.30	93.47
001-002	Guard Booth East Parking Lot	\$17,234.35	\$1,413.22	91.80
001-003	Guard Booth West Loading Dock	\$15,392.07	\$7.70	99.95
001-004	Guard Booth West Parking Lot	\$17.231.23	\$198.16	98.85
001-005	Chiller Plant	\$26,335,140.08	\$1,316,757.00	95
001-006	Trailer	\$170,811.42	\$18,635.53	89.09
001-010	Guard Booth East Loading Dock	\$15,392.07	\$76.96	99.50
031-001	National Museum of American History	\$837,878,015,74	\$101,802,178.91	\$7.80
031-002	Guard Booth East Parking Lot	\$22,786.76	\$159.51	99.30
031-003	Guard Booth West Parking Lot	\$22,786.76	\$91.15	99.60
031-005	Smithsonian Early Enrichment Center (SEEC)	\$1,558,332.00	\$0.00	100
061-001	National Air & Space Museum	\$902,583,876.79	\$279,349,709.87	69.05
061-001x	Future NASM	\$0.00	\$0.00	100
061-002	Guard Booth East Loading Dock	\$58,571,15	\$1,171.42	98
061-003	Guard Booth Parking Lot	\$59,962.78	\$1,199.26	98
061-004	SI Staff NASM Construction Trailer	\$0.00	\$0.00	100
061-005	NASM Construction Trailer	\$0.00	\$0.00	100
061-006	Phoebe Waterman Haas Public Observatory	\$0.00	\$0.00	100
091-001	Quadrangle	\$513,761,293.97	\$62,627,501.73	87.81
091-002	Guard Booth - South Side	\$18,030.56	\$1,325.25	92.65
121-001	National Museum of the American Indian	\$350,134,770,07	\$12,919,973.02	96.31
121-002	Officer Shack	\$71,147,14	\$1,992.12	97.20
151-001	Arts & Industries Building	\$279,311,923.07	\$102,004,714.31	63.48
151-002	Guard Booth South Parking	\$23,778,41	\$779.93	96,72
151-003	Freer/Ripley Garden Shed	\$0.00	\$0.00	100
151-004	Hirshhorn Garden Shed	\$0.00	\$0.00	100
181-001	Freer Gallery of Art	\$257,833,753.99	\$12,917,471.07	94.99
211-001	Hirshhorn Museum & Sculpture Garden	\$241,626,860.47	\$45,474,175.14	81.18
211-002	Guard Booth Sculpture Garden	\$25,472.21	\$50.94	99.80
211-003	Hirshhorn Tunnel/Education Center	\$1,673,776.33	\$103,774.13	93.80
211-004	HMSG Cul-de-sac Storage Building	\$0.00	\$0.00	100
241-001	Smithsonian Institution Building	\$193,937,946.78	\$73,386,119.06	62.16
271-001	National Museum of African American History and Cu	\$584,901,056.23	\$0.00	100

271-003	Guard Booth	\$73,505.52	\$0.00	100
301-001	Museum Support Center	\$252,604,032.65	\$26,068,736.17	89.68
301-002	Osteo Prep Laboratory	\$2,018,049.15	\$147,519.39	92.69
301-003	Greenhouses	\$745,364.32	\$84,598.85	88.65
301-004	Guard House	\$89,272.98	\$3,481.65	96.10
301-007	Trailer	\$131,400.00	\$16,845.48	87.18
301-008	HSD Greenhouse	\$5,177,538.00	\$44,526.83	99.14
301-009	Guard House West	\$37,822.36	\$4,746.71	87.45
331-001	Visitors Center	\$24,955,835.61	\$1,889,156.76	92.43
331-002A	Cheetah Conservation Station (Cheetah)	\$693,087.73	\$19,753.00	97.15
331-002B	Cheetah Conservation Station (Oryx)	\$197,103.70	\$5,617.46	97.15
331-002C	Cheetah Conservation Station (Wolf)	\$756,538.36	\$28,370.19	96.25
331-002D	Cheetah Conservation Station (Building)	\$345,877.54	\$9,857.51	97.15
331-004	Panda House	\$5,651,246.61	\$321,555.93	94.31
331-005A	Panda Cafe	\$472,984.01	\$24,122.18	94.90
331-005B	Bison Shelter	\$388,059.24	\$56,889.48	85.34
331-005C	Bison Shed	\$0.00	\$0.00	100
331-006	Panda Plaza Rest Rooms	\$990,019.07	\$35,739.69	96.39
331-007	Panda Plaza Information Kiosk	\$35,967.68	\$1,240.88	96.55
331-008	Panda Plaza	\$915,150.44	\$51,706.00	94.35
331-009	Elephant House	\$31,979,095.82	\$0.00	100
331-009A	Elephant Outpost Restrooms	\$1,518,841.28	\$25,820.30	98.30
331-009B	Elephant Outpost Pavilion	\$0.00	\$0.00	100
331-010	Mongolian Horses	\$234,356.00	\$24,912.04	89.37
331-010A	Wallabies	\$206,919.20	\$21,995.51	89.37
331-011	Small Mammal House	\$19,035,647.51	\$2,095,824.79	88.99
331-012	Pop Stop	\$71,267.39	\$9,763.63	86.30
331-013	Great Ape House	\$15,670,167.43	\$1,466,727.67	90.64
331-014	Gibbon Ridge	\$213,290.26	\$21,158.39	90.08
331-015	Reptile Discovery Center	\$18,098,201.14	\$2,059,575.29	88.62
331-015A	Reptile Building 1	\$203,769.08	\$43,891.86	78.46
331-015B	Reptile Building 2	\$565,508.06	\$121,810.44	78.46
331-016	Reptile Kiosk	\$45,847.10	\$1,590.89	96.53
331-017	Think Tank	\$14,117,825.86	\$1,384,958.72	90.19
331-018	Lemur Island	\$508,151.79	\$34,452.69	93.22
331-019	Gibbon Shop	\$206,761.11	\$14,018.40	93.22
331-020	Great Cats	\$16,045,953.80	\$1,540,411.56	90.40
331-020A	Lion & Tiger Building 4	\$62,815.20	\$4,711.14	92.50
331-020B	Small Cats	\$126,699.45	\$9,502.46	92.50
331-021	Police Station	\$4,459,532.67	\$0.00	100
331-022	Mane Restaurant	\$7,371,155.49	\$888,224.24	87.95

331-023	Carousel Ticket Booth	\$26,400.02	\$0.00	100
331-024	Amazonia	\$26,876,731.20	\$5,824,187.65	78.33
331-025B	Bears (Lower)	\$2,487,273.00	\$264,645.85	89.36
331-026	Seals & Sea Lions	\$7,196,226.57	\$7,196.23	99.90
331-027	Lion/Tiger Kiosk	\$31,908.99	\$21,353.49	33.08
331-028A	Forest Carnivores 2	\$590,367.20	\$62,578.92	89.40
331-028B	Forest Carnivores 3	\$105,360.00	\$11,168.16	89.40
331-028C	Forest Carnivores 4	\$768,074.40	\$88,635.79	88.46
331-028D	Forest Carnivores 5	\$295,008.00	\$34,043.92	88.46
331-028E	Forest Carnivores 6	\$79,020.00	\$9,118.91	88.46
331-028F	Forest Carnivores 7	\$169,980.80	\$19,615.78	88.46
331-029B	Valley Keeper Building	\$455,608.62	\$1,002.34	99.78
331-029C	Beavers & Otters	\$1,124,589.45	\$0.00	100
331-029F	Bobcats	\$75,889.90	\$8,757.69	88.46
331-030	Maras	\$133,060.16	\$3,738.99	97.19
331-031	Kangaroos	\$216,707.85	\$6,089.49	97.19
331-032	Bird House	\$25,238,117.61	\$8,558,245.68	66.09
331-032C	Great Flight Cage Building	\$173,371.43	\$49,896.30	71.22
331-032D	Bird House Containment Area-D	\$90,807.90	\$10,551.88	88.38
331-034	General Services Building	\$75,661,058.30	\$5,311,406.29	<mark>92.98</mark>
331-036	Boiler Plant	\$1,908,511.45	\$336,852.27	82.35
331-037	Propagation Building	\$9,501,756.76	\$679,375.61	92.85
331-040	Holt House	\$2,968,229.06	\$3,795,177.68	-27.86
331-041	Property Yard Storage	\$513,239.46	\$69,667.79	86.43
331-043	Conservation Biology	\$16,962,561.02	\$1,238,266.95	92.70
331-043A	Center for Conservation and Evolutionary Genetics	\$1,108,320.17	\$1,219.15	99.89
331-045	Veterinary Hospital	\$20,997,353.58	\$1,948,554.41	90.72
331-046	Necropsy	\$1,497,475.36	\$48,218.71	96.78
331-047	Quarantine	\$1,563,806.65	\$151,376.48	90.32
331-048	SF OPDC Hawthorn Street Field Office	\$242,953.86	\$24,271.09	90.01
331-049	Hawthorne Street Substation	\$273,754.34	\$6,734.36	97.54
331-050A	Main Barn	\$937,430.50	\$19,686.04	97.90
331-050B	Chicken House	\$63,267.20	\$208.78	99.67
331-050C	Pig House	\$65,751.41	\$216.98	99.67
331-051	FONZ Trailer	\$896,067.22	\$116,040.71	87.05
331-052	Sloth Bear	\$2,791,521.24	\$43,826.88	98.43
331-053	Fountain Pump Room	\$94,236.48	\$47.12	99.95
331-054A	Trestle Mechanical Equipment	\$152,850.09	\$152.85	99.90
331-055	Asia Trail Mechanical Room	\$2,044,507.14	\$4,702.37	99.77
331-056A	Prairie Exhibit Pavilion 1	\$31,557.10	\$2,379.41	<mark>92.46</mark>
331-056B	Prairie Exhibit Pavilion 2	\$31,557.10	\$2,379.41	92.46

331-056C	Prairie Exhibit Pavilion 3	\$0.00	\$0.00	100
331-057	Guard Booth - Main Entrance	\$15,765.41	\$575.44	96.35
331-058	FONZ Storage Shed	\$67,754.63	\$0.00	100
331-059	Panda Support Building	\$114,849.92	\$4,938.55	95.70
331-060	Hay Storage	\$332,938.30	\$998.81	99.70
331-063	Lamp Storage	\$42,541.09	\$5,509.07	87.05
331-064	Asian Small Clawed Otters	\$278,505.60	\$1,949.54	99.30
331-065A	Ticket Booth A	\$16,661.52	\$2,490.90	85.05
331-065B	Ticket Booth B	\$24,992.28	\$3,811.32	84.75
331-065C	Ticket Booth C	\$17,587.16	\$2,629.28	85.05
331-065D	Ticket Booth D	\$16,651.50	\$2,489.40	85.05
331-065E	Ticket Booth E	\$13,882.32	\$2,075.41	85.05
331-070	Greenhouses Research Hill	\$1,476,446.49	\$29,528.93	98
331-080	Pelican House	\$57,349.52	\$57.35	99.90
331-082	Seal Rock Cafe	\$79,181.61	\$118.77	99.85
331-083	Red Panda Holding Building	\$43,399.41	\$0.00	100
331-130	Stanley Crane House B	\$33,838.72	\$443.29	98.69
331-131	Stanley Crane House A	\$33,838.72	\$443.29	98.69
331-132	Kori Bustard House 1	\$33,838.72	\$443.29	98.69
331-133	White Stork House	\$33,838.72	\$443.29	98.69
331-134	Whooping Crane House	\$33,838.72	\$443.29	98.69
331-135a	Wild Bird Demo House	\$150,262.65	\$1,968.44	98.69
331-135b	Kori Bustard House 2	\$33,838.72	\$443.29	98.69
331-135c	Kori Bustard House 3	\$32,725.76	\$428.71	98.69
331-136	Four Bird Run House	\$223,266.96	\$2,924.80	98.69
331-140	American Flamingo House	\$171,480.00	\$2,246.39	98.69
331-141	Greater Rhea House	\$33,838.72	\$443.29	98.69
331-143	Emu House	\$188,984.46	\$2,475.70	98.69
331-144a	144a	\$13,718.40	\$179.71	98.69
331-144b	144b	\$27,436.80	\$359.42	98.69
331-144c	144c	\$27,436.80	\$359.42	98.69
331-144d	144d	\$27,436.80	\$359.42	98.69
331-160	Conservation Pavilion & Public Restrooms	\$3,417,406.08	\$0.00	100
331-26CV	Sea Lion Viewing Pavilion	\$107,245.50	\$0.00	100
455-003	Building 03	\$531,578.70	\$36,147.35	93.20
455-004	Building 04	\$531,578.70	\$40,612.61	<mark>92.36</mark>
455-005	Building 05	\$531,578.70	\$46,141.03	<mark>91.32</mark>
455-006	Building 06	\$531,578.70	\$50,925.24	90.42
455-007	Building 07	\$2,524,295.13	\$219,613.68	<mark>91.30</mark>
455-008	Building 08	\$475,550.41	\$83,221.32	82.50
455-009	Building 09	\$622,008.38	\$91,435.23	85.30

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455-010	Building 10	\$5,146,937.35	\$400,431.73	92.22
455-011	Building 11	\$532,076.63	\$46,290.67	91.30
455-012	Building 12	\$922,157.68	\$47,030.04	94.90
455-013	Building 13	\$1,397,816.78	\$102,739.53	92.65
455-015	Building 15	\$1,875,835.20	\$275,747.77	85.30
455-016	Building 16	\$1,576,800.00	\$52,034.40	96.70
455-017	Building 17	\$3,585,908.41	\$311,974.03	<mark>91.30</mark>
455-018	Building 18	\$1,592,995.05	\$149,104.34	<mark>90.64</mark>
455-019	Building 19	\$1,992,024.00	\$173,306.09	91.30
455-020	Building 20	\$2,657,877.07	\$254,624.62	90.42
455-022	Building 22	\$2,633,136.43	\$271,739.68	89.68
455-023	Building 23	\$2,856,858.77	\$294,827.82	89.68
455-024	Building 24	\$3,216,463.95	\$275,007.67	91.45
455-025	Building 25	\$1,304,686.92	\$0.00	100
455-026	Building 26	\$1,984,277.00	\$32,145.29	98.38
455-027	Building 27	\$1,576,800.00	\$753,552.72	52.21
455-028	Building 28	\$2,975,958.65	\$374,078.00	87.43
455-029	Building 29	\$293,284.80	\$38,039.04	87.03
455-030	Building 30	\$509,175.00	\$10,998.18	97.84
455-031	Building 31	\$2,748,165.30	\$63,482.62	97.69
455-032	Building 32	\$264,990.00	\$30,738.84	88.40
455-033	Building 33	\$1,136,281.65	\$22,384.75	98.03
455-034	Building 34	\$1,012,087.27	\$111,329.60	<mark>89</mark>
455-035	Fleet Maintenance Building	\$10,987,846.97	\$23,074.48	99.79
455-036	Fire Pump Enclosure	\$198,835.20	\$4,970.88	97.50
455-037	Building 37	\$2,485,069.65	\$0.00	100
455-10A	Museum Support 10A	\$67,276.76	\$12,930.59	80.78
455-10B	Environmental 10B	\$73,121.99	\$7,063.58	90.34
455-10C	Environmental 10C	\$23,126.40	\$2,775.17	88
455-10D	Environmental 10D	\$3,493.05	\$419.17	88
455-10F	Environmental 10F	\$7,489.80	\$898.78	88
455-16A	Building 16A	\$20,668.08	\$4,092.28	80.20
485-001	D. W. Reynolds Center	\$470,303,182.74	\$17,354,187.44	96.31
515-001	NMAI Cultural Resource Center	\$52,720,280.68	\$3,068,320.34	<mark>94.18</mark>
515-002	Guard House	\$94,572.36	\$8,227.80	<mark>91.30</mark>
545-001	Udvar-Hazy Center	\$495,402,156.92	\$71,882,852.97	85.49
545-005	Parking Administration Building	\$522,976.16	\$8,629.11	98.35
545-006	Toll Booth 1	\$35,040.49	\$0.00	100
545-007	Toll Booth 2	\$35,045.11	\$0.00	100
545-008	Toll Booth 3	\$35,054.60	\$3,996.22	88.60
545-009	Toll Booth 4	\$35,049.54	\$3,522.48	89.95

545-010	Toll Booth 5	\$35,064.16	\$5,101.83	85.45
545-011	Storage Barn	\$3,976,628.84	\$73,567.63	98.15
545-012	Guard Booth Route 50	\$5,453.89	\$0.00	100
575-001	Renwick Gallery	\$56,277,311.05	\$219,481.51	99.61
585-001	Anacostia Museum	\$11,479,132.98	\$1,130,694.60	90.15
677-003	Ramsey Building (IAD 44735)	\$4,275,644.00	\$473,313.79	88.93
678-001	National Postal Museum	\$38,621,617.22	\$4,638,456.23	87.99
681-001	380 Herndon-Spring Park I	\$22,472,840.77	\$1,577,593.42	92.98
701-0005	Guest Cottage	\$169,520.54	\$28,360.79	83.27
701-0010	GIS Computer Lab	\$883,117.81	\$76,478.00	91.34
701-0018	Hay Storage 1	\$510,252.39	\$141,595.04	72.25
701-0019	Fire Station	\$763,481.98	\$192,015.72	74.85
701-0025	Field Ecology Office	\$599,739.60	\$73,767.97	87.70
701-0032	Grounds Equipment Storage	\$95,079.70	\$1,854.05	98.05
701-0040	MFH House 40 Administration Drive	\$853,201.85	\$52,727.87	93.82
701-0041	Garage 0041	\$183,067.43	\$1,830.67	99
701-0044	Hay Storage 2	\$322,407.23	\$43,331.53	86.56
701-0046	Grounds Maintenance Equipment Storage	\$1,010,657.26	\$317,649.58	68.57
701-0047	Hay Storage 3	\$845,152.00	\$21,044.28	97.51
701-0054	MFH Duplex (54 is NZP Police Office, 56 Apt)	\$407,736.65	\$36,614.75	91.02
701-0056	Private Residence 0056	\$407,738.30	\$28,867.87	92.92
701-0058	Farm Equipment Storage	\$678,689.34	\$133,023.11	80.40
701-0062	Garage 0062	\$61,773.87	\$10,303.88	83.32
701-0064	Garage 0064	\$54,350.90	\$1,353.34	97.51
701-0065	Tractor Storage Shed	\$1,901,592.00	\$358,830.41	81.13
701-0069	SMSC Dining Facility	\$2,544,060.41	\$0.00	100
701-0073	Maintenance Craft Shops	\$893,574.59	\$39,496.00	95.58
701-0074	Longfield Shelter 3	\$82,310.49	\$724.33	99.12
701-0078	Lumber Storage Shed	\$400,543.66	\$36,930.13	<mark>90.78</mark>
701-0082	MFH House 82 Collins Circle	\$437,746.30	\$45,875.81	89.52
701-0083	Administration Building	\$2,308,977.17	\$1,172,267.71	49.23
701-0086	King 2	\$327,470.18	\$6,680.39	97.96
701-0090	Animal Programs & Neon Office	\$3,828,834.39	\$107,973.13	97.18
701-0098	MFH House 98 Administration Drive	\$602,944.79	\$34,548.74	94.27
701-0099	COTR Office	\$159,126.28	\$4,582.84	97.12
701-0100	Garage 0100	\$123,902.61	\$32,896.14	73.45
701-0102	Welding Shop	\$488,691.54	\$49,113.50	89.95
701-0104	Mule Barn	\$2,894,089.28	\$542,641.74	81.25
701-0108	Maintenance and Research Office Building	\$1,593,908.78	\$43,035.54	97.30
701-0110	MFH House 110 Slate Hill Drive	\$1,096,342.89	\$114,896.73	89.52
701-0111	Wemmer House	\$1,197,260.09	\$92,189.03	92.30

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701-0115	MFH House 115 Long Hill Road	\$348,801.27	\$26,264.74	92.47
701-0116	SMSC Academic Building	\$7,373,674.83	\$0.00	100
701-0129	Recycling Center	\$327,607.98	\$81,901.99	75
701-0133	Commissary and Supply	\$2,630,196.35	\$146,764.96	94.42
701-0139	King 1	\$20,499.88	\$8,954.35	56.32
701-0142	MFH House 142 Slate Hill Drive	\$602,896.52	\$53,537.21	91.12
701-0143	Scale House	\$97,441.92	\$15,629.68	83.96
701-0145	Hardy Bird House	\$69,983.55	\$11,547.29	83.50
701-0147	Lower Wolf Facility	\$407,905.78	\$17,743.90	95.65
701-0148	Breeding Barn	\$477,933.43	\$96,781.52	79.75
701-0158	Wastewater Sedimentation Tank	\$122,866.17	\$1,228.66	99
701-0173	Church Barn	\$3,047,862.85	\$684,245.21	77.55
701-0175	MFH House 175 Marvin Drive	\$430,830.89	\$85,347.60	80.19
701-0181	Animal Supply	\$396,165.00	\$5,744.39	98.55
701-0184	SMSC Residence Hall	\$10,979,926.86	\$0.00	100
701-0200	Guardhouse	\$67,199.71	\$0.00	100
701-0231	Archives Storage Facility	\$361,713.71	\$84,821.86	76.55
701-0234	Horse Barn	\$754,221.27	\$167,060.01	77.85
701-0245	Animal Buildings 1&2	\$3,768,967.34	\$0.00	100
701-0277	Dormitory (Research Drive)	\$990,551.89	\$45,961.61	95.36
701-0285	Auditorium	\$1,610,668.15	\$28,669.89	98.22
701-0302	Upper Wolf Building	\$100,860.48	\$1,109.47	98.90
701-0303	MFH Apt 303 and Research Office	\$435,407.64	\$14,063.67	96.77
701-0317	Research Office and Laundry	\$484,520.51	\$66,912.28	86.19
701-0318	Veterinary Hospital	\$3,674,690.65	\$528,053.05	85.63
701-0338	MFH Apt (23,318) and Office Annex	\$4,683,214.77	\$149,862.87	96.80
701-0346	Kiwi Flats	\$211,270.44	\$4,331.04	97.95
701-0371	Garage 0371	\$103,585.68	\$115,498.03	-11.50
701-0395	Vehicle Repair Shop	\$412,531.42	\$174,913.32	57.60
701-0407	Boiler Room/Mason Shop	\$321,974.33	\$27,496.61	<mark>91.46</mark>
701-0412	Carpenter Shop	\$509,060.60	\$43,117.43	<mark>91.53</mark>
701-0445	Maintenance Warehouse	\$1,059,384.03	\$167,594.55	84.18
701-0460	Small Animal Facility	\$9,713,737.18	\$665,391.00	<mark>93.15</mark>
701-0467	Dormitory Leach House	\$1,625,949.20	\$157,554.48	<mark>90.31</mark>
701-0576	Green Hill Barn	\$2,452,889.25	\$423,123.40	82.75
701-0619	Green Hill Shelter	\$514,986.86	\$4,377.39	99.15
701-0740	MFH House 74	\$1,527,049.47	\$304,493.66	80.06
701-0780	Upper Storage Shed	\$507,560.73	\$60,399.73	88.10
701-082A	Storage Shed at Residence 0082	\$48,141.97	\$9,435.83	80.40
701-082B	Garage and Carport at Residence 0082	\$77,028.42	\$15,097.57	80.40
701-083A	Cellar	\$36,690.64	\$5,026.62	86.30

701-0860	MFH House 86 Administration Drive	\$608,925.08	\$46,887.23	92.30
701-0865	Training Hall Storage Building	\$1,039,695.43	\$100,226.64	<mark>90.36</mark>
701-086A	Lower Research Shed	\$262,748.27	\$65,030.20	75.25
701-0978	Slate Hill Barn	\$2,978,670.75	\$25,318.70	99.15
701-0981	Slate Hill Shelter	\$459,551.40	\$3,906.19	99.15
701-1016	MFH House 1016 Slate Hill Drive	\$938,858.23	\$25,255.29	97.31
701-1154	Stone House	\$610,882.12	\$39,279.72	93.57
701-1166	Garage 1166	\$194,073.88	\$35,282.63	81.82
701-1180	MFH House 118	\$1,554,606.11	\$782,899.64	49.64
701-1316	Longfield Shelter 1	\$95,079.70	\$2,462.56	97.41
701-133A	Shed	\$92,447.13	\$11,722.30	87.32
701-1375	Rivinus Barn	\$2,347,874.03	\$27,704.91	98.82
701-1437	Rivinus Annex	\$887,409.60	\$59,012.74	93.35
701-152A	Hazmat Storage A	\$16,993.53	\$33.99	99.80
701-152B	Hazmat Storage B	\$16,993.53	\$86.66	99.49
701-152C	Hazmat Building	\$34,862.52	\$1,886.06	<mark>94.59</mark>
701-1561	Longfield Shelter 5	\$152,867.34	\$2,430.59	98.41
701-1562	Longfield Shelter 4	\$152,863.43	\$2,430.53	98.41
701-2518	MFH House 2518 Remount Road	\$298,499.52	\$38,804.94	87
701-3015	Meade Barn	\$2,973,405.80	\$37,167.57	98.75
701-3019	Meade Shelter	\$460,174.86	\$54,760.81	88.10
701-318A	Hazmat Storage Building	\$103,317.79	\$2,510.62	97.57
701-3200	Longfield Shelter 2	\$95,079.60	\$836.70	99.12
701-3289	Waller Barn	\$2,902,374.01	\$36,279.68	98.75
701-3293	Waller Shelter	\$523,952.30	\$45,321.87	<mark>91.35</mark>
701-467A	Lower Barn at Leach House	\$136,314.00	\$156,761.10	-15.00
701-467B	Upper Barn at Leach House	\$136,314.00	\$51,117.75	62.50
701-58ES	Equipment Storage Shed	\$455,515.95	\$119,800.69	73.70
701-58FE	Farm Equipment Shed	\$595,546.10	\$104,458.79	82.46
701-7400	MFH Duplex (74,76)	\$410,808.84	\$27,606.35	93.28
701-7600	Private Residence 7600	\$409,990.75	\$20,991.53	<mark>94.88</mark>
701-78HB	Hay Storage Farm Road	\$351,408.00	\$28,920.88	91.77
701-9800	MFH House 98	\$519,244.25	\$397,169.93	23.51
701-CH01	Cheetah Building 1	\$65,521.61	\$65.52	99.90
701-CH02	Cheetah Building 2	\$65,521.61	\$65.52	99.90
701-CH03	Cheetah Building 3	\$65,521.61	\$65.52	99.90
701-CH04	Cheetah Building 4	\$65,521.61	\$65.52	99.90
701-CH05	Cheetah Building 5	\$65,521.61	\$65.52	99.90
701-CH06	Cheetah Building 6	\$65,521.61	\$65.52	99.90
701-CH07	Cheetah Building 7	\$65,521.61	\$65.52	99.90
701-CH08	Cheetah Keeper Building	\$52,822.00	\$52.82	99.90

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701-CH09	Cheetah Keeper Restroom	\$15,013.01	\$15.01	99.90
701-CH10	Cheetah Storage Shed	\$57,470.43	\$0.00	100
701-CL01	Clouded Leopard Building 1	\$318,501.61	\$0.00	100
701-CL02	Clouded Leopard Building 2	\$318,501.61	\$0.00	100
701-CL03	Clouded Leopard Building 3	\$318,501.61	\$0.00	100
701-CL04	Clouded Leopard Building 4	\$318,501.61	\$0.00	100
701-CL05	Clouded Leopard Building 5	\$318,501.61	\$0.00	100
701-CR01	Crane Shelter 01	\$3,944.61	\$71.00	98.20
701-CR02	Crane Shelter 02	\$3,944.61	\$71.00	98.20
701-CR03	Crane Shelter 03	\$3,944.61	\$71.00	98.20
701-CR04	Crane Shelter 04	\$3,944.61	\$71.00	98.20
701-CR05	Crane Shelter 05	\$3,944.61	\$71.00	98.20
701-CR06	Crane Shelter 06	\$3,944.61	\$71.00	98.20
701-CR07	Crane Shelter 07	\$3,944.61	\$71.00	98.20
701-CR08	Crane Shelter 08	\$3,944.61	\$71.00	98.20
701-CR09	Crane Shelter 09	\$3,944.61	\$71.00	98.20
701-CR10	Crane Shelter 10	\$3,944.61	\$71.00	98.20
701-CR11	Crane Shelter 11	\$3,944.61	\$71.00	98.20
701-CR12	Crane Shelter 12	\$3,944.61	\$71.00	98.20
701-CR13	Crane Shelter 13	\$3,944.61	\$71.00	98.20
701-CR14	Crane Shelter 14	\$3,944.61	\$71.00	98.20
701-CR15	Crane Shelter 15	\$3,944.61	\$71.00	98.20
701-CR16	Crane Shelter 16	\$3,944.61	\$71.00	98.20
701-CR17	Crane Shelter 17	\$3,944.61	\$71.00	98.20
701-CR18	Crane Shelter 18	\$3,944.61	\$71.00	98.20
701-CR19	Crane Shelter 19	\$3,944.61	\$71.00	98.20
701-CR20	Crane Shelter 20	\$3,944.61	\$71.00	98.20
701-CR21	Crane Shelter 21	\$3,944.61	\$71.00	98.20
701-PH01	Pump House 1	\$39,041.72	\$14,425.92	63.05
701-PH02	Pump House 2	\$22,852.62	\$2,447.52	89.29
701-PH03	Pump House 3	\$33,164.80	\$749.52	97.74
701-PH04	Pump House 4	\$41,306.73	\$4,423.95	89.29
701-PH05	Pump House 5	\$20,728.00	\$1,171.13	<mark>94.35</mark>
701-PH06	Pump House 6	\$20,728.00	\$1,511.07	92.71
701-RP01	Red Panda Enclosure 1	\$53,102.52	\$0.00	100
701-RP02	Red Panda Enclosure 2	\$106,204.93	\$0.00	100
701-RP03	Red Panda Enclosure 3	\$106,204.93	\$0.00	100
701-RP04	Red Panda Enclosure 4	\$62,475.04	\$0.00	100
701-RP05	Red Panda Enclosure 5	\$62,476.18	\$0.00	100
701-RP06	Red Panda Enclosure 6	\$43,233.34	\$0.00	100
701-T001	Muntjac Tower	\$118,899.02	\$3,317.28	97.21

701-WE01	Weir 1	\$0.00	\$0.00	100
701-WE02	Weir 2	\$0.00	\$0.00	100
789-002	Storage Shed	\$39,051.22	\$21,321.97	45.40
789-003	Dining and Kitchen	\$546,202.27	\$261,248.55	52.17
789-005	Dormitories	\$403,667.40	\$504,745.71	-25.04
789-006	Bathroom	\$187,091.43	\$127,128.63	32.05
789-007	House	\$595,923.89	\$745,143.24	-25.04
789-008	Laundry/Storage	\$259,959.55	\$326,639.17	-25.65
790-001	Los Asientos Field Station	\$204,084.88	\$0.00	100
790-002	Venao Storage	\$10,562.17	\$0.00	100
791-001	Field Station	\$666,537.46	\$0.00	100
792-001	Library	\$6,783,413.47	\$1,018,190.36	84.99
792-002	Tupper Laboratory & Dining Building	\$26,959,060.95	\$6,610,361.75	75.48
792-003	Tupper Conference Center	\$3,882,329.68	\$362,609.59	<mark>90.66</mark>
792-004	Toxic Waste	\$4,716.10	\$221.66	95.30
792-005	Administration Building	\$4,151,619.45	\$1,176,153.79	71.67
792-006	Engineering Office	\$1,128,383.75	\$101,893.05	<mark>90.97</mark>
792-007	Hazmat Storage	\$63,310.98	\$15,511.19	75.50
792-008	Emergency Generator Building	\$184,685.58	\$9,086.53	95.08
792-009	Guard Booth - Secondary	\$2,691.18	\$147.21	<mark>94.53</mark>
792-010	Maintenance/General Services Building	\$4,266,712.40	\$782,515.05	81.66
792-011	Guard Booth - Main Entrance	\$32,252.98	\$64.51	99.80
793-006	Storage	\$5,890.07	\$753.93	87.20
794-001	Kitchen/Dining/Conference Building	\$6,827,720.35	\$733,979.94	89.25
794-002	Laundry/Apartment (Building A)	\$885,388.10	\$194,696.84	78.01
794-003	Staff Housing Building B	\$1,168,658.87	\$296,722.49	74.61
794-004	Staff Housing Building C	\$1,180,728.10	\$299,786.86	74.61
794-005	Staff Housing Building D	\$1,194,697.57	\$221,974.81	81.42
794-006	Staff Housing Building E	\$1,172,796.33	\$112,002.05	<mark>90.45</mark>
794-007	Staff Housing Building F	\$1,170,490.23	\$129,690.32	88.92
794-008	Chefs Dormitory	\$823,474.27	\$220,773.45	73.19
794-009	Game Warden Dormitory	\$1,898,858.74	\$861,891.98	54.61
794-010	Scientific Dormitory SN	\$2,520,499.11	\$1,108,011.41	56.04
794-016	Greenhouse Building 9	\$846,206.61	\$254,708.19	69.90
794-018	Laboratory Building 8	\$18,217,410.25	\$2,109,576.11	88.42
794-019	Sewage Treatment Plant	\$475,024.16	\$5,890.30	98.76
794-021	New Visitors Center	\$2,078,552.82	\$0.00	100
794-022	Insectary	\$135,953.91	\$193,938.26	-42.65
794-024	Greenhouse	\$125,486.29	\$3,827.33	96.95
794-025	Smith House	\$552,495.97	\$103,924.49	81.19
794-026	Carpenter House	\$432,077.78	\$115,840.05	73.19

794-029	Hydrology Lab 1	\$25,458.96	\$1,667.56	<mark>93.45</mark>
794-030	Hydrology Lab 2	\$38,744.32	\$1,820.98	95.30
794-032	Sewage Pump Station on Hill	\$40,662.70	\$2,785.40	93.15
794-034	Transformer Building	\$35,401.69	\$10,043.46	71.63
794-036	Haskins Building	\$273,973.91	\$54,329.03	80.17
794-038	Booster Pump House	\$12,656.82	\$122.77	99.03
794-039	Sewage Pump House at Dock	\$35,220.32	\$2,187.18	<mark>93.79</mark>
794-040	Growing House Building 21	\$91,239.37	\$112,087.57	-22.85
794-043	Staff Housing Building G	\$528,334.86	\$91,296.26	82.72
794-045	Storage Building	\$17,031.87	\$323.61	98.10
794-046	Center for Tropical Forest Science	\$445,469.89	\$63,033.99	85.85
794-048	Sewage Treatment Plant (Old)	\$311,852.98	\$6,923.14	97.78
794-049	Soils Laboratory	\$199,885.07	\$4,757.26	97.62
794-050	Telecommunication Building	\$69,398.86	\$4,503.99	<mark>93.51</mark>
794-054	Greenhouse Lab 1	\$96,213.56	\$9,044.07	<mark>90.60</mark>
794-055	Greenhouse Lab 2	\$72,524.94	\$6,817.34	<mark>90.60</mark>
794-057	Diesel Transfer Storage Shed	\$16,194.03	\$631.57	96.10
794-058	Game Warden Station	\$288,547.96	\$0.00	100
795-001	Sewage Treatment Plant	\$166,483.36	\$19,728.28	88.15
795-002	Aquarium 332	\$1,934,130.41	\$777,520.43	59.80
795-003	Dive Locker 315	\$238,374.55	\$31,227.07	86.90
795-004	Laboratory/Administration (356)	\$2,832,816.05	\$255,236.73	<mark>90.99</mark>
795-006	Shop & Storage(Ismael)	\$131,105.39	\$10,711.31	91.83
795-007	Laboratory 359	\$11,819,405.44	\$1,726,815.14	85.39
795-008	Surfside Theater (352)	\$8,481,048.10	\$1,323,891.61	84.39
795-009	Bunker No. 1	\$120,993.43	\$30,369.35	74.90
795-010	Bunker No. 2	\$73,686.21	\$16,063.59	78.20
795-013	Sewage Pump Station No. 1	\$30,966.71	\$7,509.43	75.75
795-018	Emergency Generator	\$317,944.60	\$19,140.26	<mark>93.98</mark>
795-020	Fire Pump Station	\$40,171.51	\$5,322.72	86.75
795-022	Guard Booth	\$21,213.47	\$2,395.00	88.71
795-023	Storage Building (361)	\$56,941.74	\$7,288.54	87.20
796-001	Toilet Room	\$30,649.68	\$3,677.96	88
796-002	Generator & Maintenance	\$182,815.93	\$21,535.72	88.22
796-003	Dormitory	\$211,400.27	\$19,617.95	<mark>90.72</mark>
796-005	Storage	\$12,946.39	\$1,793.07	86.15
797-002	Storage Building (6707)	\$43,728.61	\$4,525.91	89.65
797-003	Laboratory (6701)	\$2,922,698.25	\$414,146.34	85.83
797-004	Storage Building (6703)	\$83,558.33	\$10,528.35	87.40
797-006	Storage Shed	\$5,693.63	\$1,839.04	67.70
797-009	Dormitory 3	\$125,095.76	\$4,353.33	96.52

797-010	Dormitory 2	\$138.488.34	\$4.819.39	96.52
797-011	Dormitory 1	\$138,484,64	\$5.068.54	96.34
797-012	Bathroom (6702)	\$773.663.34	\$92.839.60	88
797-018	Office	\$40,702.75	\$11,982.89	70.56
797-020	Generator Building	\$28,762.58	\$2.870.51	90.02
798-001	Ancon Apartments	\$1,441,395.48	\$706,427.93	50.99
798-002	Gorgas Laboratory (Building 235)	\$7,699,748.12	\$2,333,793.66	69.69
799-001	Bunker No. 1	\$448,889.35	\$48,300.49	89.24
799-002	Bunker No. 2	\$649,321.56	\$65,062.02	89.98
799-003	Bunker No. 3	\$466,243.03	\$28,207.70	93.95
799-004	Bunker No. 4	\$151,034.89	\$10,723.48	92.90
799-005	Bunker No. 5	\$655,127.83	\$49,134.59	<mark>92.50</mark>
799-006	Bunker No. 6	\$427,033.90	\$34,034.60	92.03
799-007	Pavilion	\$323,527.03	\$29,020.37	91.03
799-013	Electric Shed & Pump House	\$88,884.45	\$7,421.85	91.65
799-014	Guard Booth	\$16,244.83	\$1,991.62	87.74
800-001	Elementary School - Dorm (56)	\$12,344,790.40	\$4,392,276.42	64.42
800-002	Apartment Building (183)	\$6,436,425.64	\$3,153,848.56	51
800-004	ACP (152)	\$1,319,972.05	\$175,424.29	86.71
800-005	ACP (150)	\$1,325,508.20	\$222,817.93	83.19
800-006	Gamboa Rainforest Resort (268)	\$1,688,036.35	\$25,151.74	98.51
800-012	Toilets	\$183,655.28	\$22,130.46	87.95
800-013	Oxidizer Storage	\$31,554.95	\$43,703.61	-38.50
800-014	Shed	\$121,047.02	\$12,528.37	89.65
800-017	Old Schoolhouse - Santa Cruz (078)	\$1,312,688.50	\$1,092,288.10	16.79
800-018	Gym - Santa Cruz	\$2,233,891.78	\$2,822,745.65	-26.36
800-021	Guard Booth	\$29,587.40	\$1,130.24	96.18
800-022	Electric Panel	\$2,012.85	\$1,180.54	41.35
800-023	Generator Shed	\$15,683.25	\$407.76	97.40
800-024	Visitor's Booth	\$293,846.34	\$13,046.78	95.56
800-027	Storage Building	\$18,242.13	\$2,262.02	87.60
800-061	Butterfly House 1	\$65,454.00	\$7,559.94	88.45
800-062	Butterfly House 2	\$65,454.00	\$7,559.94	88.45
800-063	Butterfly House 3	\$65,454.00	\$7,559.94	88.45
800-064	Butterfly House 4	\$65,454.00	\$9,484.28	85.51
800-066	Bat Lab	\$106,035.48	\$2,438.82	97.70
800-067	Amphibian Rescue Building 1	\$32,290.64	\$742.68	97.70
800-068	Amphibian Rescue Building 2	\$32,290.64	\$742.68	97.70
800-069	Amphibian Rescue Building 3	\$32,290.64	\$742.68	97.70
800-070	Amphibian Rescue Building 4	\$32,290.64	\$742.68	97.70
800-071	Amphibian Rescue Building 5	\$32,290.64	\$742.68	97.70

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800-072	Amphibian Rescue Building 6	\$32,290.64	\$742.68	97.70
800-073	Amphibian Rescue Building 7	\$32,290.64	\$742.68	97.70
800-074	Amphibian Rescue Center	\$157,957.96	\$0.00	100
800-075	Gamboa Rainforest Resort (275)	\$1,837,297.79	\$0.00	100
800-076	Gamboa Laboratory (076)	\$23,855,600.00	\$0.00	100
800-077	Building 155	\$2,043,189.69	\$0.00	100
801-001	Student Dormitory	\$1,641,899.85	\$304,572.42	81.45
801-002	Laboratory Building	\$17,687,955.44	\$1,459,256.32	91.75
801-003	Generator Station	\$295,526.80	\$8,599.83	97.09
801-004	Storage	\$4,022.92	\$312.18	92.24
801-006	Dive Locker	\$288,243.45	8,243.45 \$12,855.66	
801-007	Sea Water System	\$391,979.41	\$91,448.80	76.67
801-008	Mechanical Shop	\$2,477,574.98	\$282,691.30	88.59
801-009	Fuel Storage	\$33,747.75	\$931.44	97.24
801-010	Hoch House	\$1,516,818.27	\$65,223.19	95.70
801-011	Administration Building	\$1,943,405.89	\$371,384.86	80.89
801-013	Water Tank Shed	\$180,314.42	\$7,699.43	95.73
801-014	Toilet	\$17,810.77	\$1,683.12	90.55
801-015	Guard Booth	\$41,672.86	\$3,192.14	92.34
801-016	Electric Panel	\$19,103.31	\$2,225.54	88.35
801-018	Cofrin House	\$1,519,911.96	\$163,846.51	89.22
801-019	Researcher's Dormitory	\$346,797.11	\$11,860.46	96.58
801-020	Acidification Lab	\$34,363.35	\$3,652.82	89.37
801-021	Facilities Building	\$169,853.13	\$3,940.59	97.68
803-003	El Giral - House #3 - Quintero	\$267,312.82	\$0.00	100
803-033	El Giral - House #33 - Romero	\$386,657.07	\$0.00	100
804-001	Bathroom	\$1,910.30	\$43.94	97.70
804-005	Office	\$9,535.57	\$219.32	97.70
804-006	Container	\$9,888.90	\$314.47	96.82
807-001	House & Shop	\$605,200.75	\$213,938.46	64.65
807-002	Employee's Dormitory	\$98,601.82	\$81,366.22	17.48
807-003	Generator Shed	\$8,339.92	\$4,853.83	41.80
807-004	Old House at the Beach	\$559,935.87	\$715,934.00	-27.86
807-005	Toilets	\$17,911.96	\$8,547.59	52.28
808-001	House (5)	\$563,154.66	\$78,334.81	86.09
808-002	House (834A)	\$232,646.86 \$32,361.18		86.09
808-003	House (835A&B)	\$466,847.26 \$64,938.45		86.09
808-004	House (837A&B)	\$471,036.03	\$65,521.11	86.09
811-001	Carnegie Mansion	\$193,619,510.74	\$22,053,262.27	88.61
811-002	Miller Fox House	\$134,881,862.51	\$5,584,109.11	95.86
813-001	Newark Building	\$12,051,705.41	\$241,034.11	98

821-030A	Storage Building #30A	\$13,835,52	\$2.241.35	83.80
821-100	Charles Mathias Laboratory	\$49.385.126.10	\$0.00	100
821-102	Pump House	\$25,969,82	\$703.80	97.29
821-108	Fire Suppression Tower Support Building	\$14 247 00	\$786.43	94.48
821-110	Pole Barn	\$25,687,50	\$0.00	100
821-115	Maintenance Storage Building	\$285 708 28	\$18,999,60	93.35
821-120	Maintenance Shop	\$2 220 629 51	\$87,936,93	96.04
821-125	Storage Building	\$1 292 160 01	\$32,950,08	97.45
821-127	Chemical Storage Shed A	\$22,869,51	\$658.64	07.12
821-127	Chemical Storage B	\$75,816,40	\$2 183 51	07.12
021-120 921-121	Meteorological Towar Support Puilding	\$65,702,40	\$2,185.51	97.12
021-131 921-145	New Dominion Puilding	\$5,012,728,22	\$2,028.10	<u>90</u>
021-145	Joan Schmidt Conference Center and Dermitery	\$1,015,022,85	\$700,082.75	09.12
021-100	Crean Village Dermitary	\$1,913,932.83	\$33,827.94	96.15
821-165	Deed Creater Education Duilding	\$2,009,790.31	\$57,403.52	90.19
821-200		\$2,193,242.97	\$41,013.64	98.13
821-201	Reed Center Well House	\$27,610.82	\$596.39	97.84
821-210	Fuel Shed	\$76,077.44	\$1,620.45	97.87
821-211	Waterfront Equipment Storage Building	\$77,447.48	\$2,029.12	97.38
821-220	Wet Laboratory	\$1,473,657.11	\$264,816.18	82.03
821-221	Wet Laboratory Well House	\$11,826.72	\$793.57	<u>93.29</u>
821-261	Main Dock Instrument Shed 1	\$54,718.80	\$2,599.14	95.25
821-262	Main Dock Instrument Shed 2	\$54,718.80	\$2,051.96	96.25
821-290	Education Tobacco Barn	\$35,774.00	\$622.47	98.26
821-S01	WWTP Chem Shed	\$27,670.40	\$0.00	100
821-S02	Radiation Waste Storage Shed	\$26,940.65	\$751.64	97.21
821-S03	Equipment Storage Shed - Nutrition Ecology	\$61,843.20	\$1,669.77	97.30
821-S04	Equipment Storage Shed -Marine Invasions	\$51,536.00	\$1,391.47	97.30
821-S05	Equipment Storage Shed-Admin	\$55,570.37	\$1,500.40	97.30
821-S06	Equipment Storage Shed - Terrestrial Ecology	\$61,843.20	\$1,113.18	98.20
821-S08	Canoe Shed	\$27,354.24	\$492.38	98.20
821-S09	Schmidt Ctr Storage Shed	\$21,195.83	\$2,522.30	88.10
821-S10	Green Village Equipment Storage Shed	\$0.00	\$0.00	100
821-S11	Auto Shop Maintenance Shed	\$0.00	\$0.00	100
821-S20	John Fischel Pavilion	\$28,329.84	\$4,022.84	85.80
821-S21	Equipment Storage Shed A	\$15,768.00	\$1,245.67	92.10
821-S22	Equipment Storage Shed B	\$15,768.00	\$1,245.67	<mark>92.10</mark>
821-S23	Equipment Storage Shed C	\$15,768.00	\$1,245.67	<mark>92.10</mark>
821-S24	Equipment Storage Shed - Crab Lab	\$63,074.40	\$7,505.85	88.10
.821-S25	Education Storage Shed	\$45,820.82	\$1,008.06	97.80
821-S26	Education Trail Shed	\$31,800.01	\$0.00	100
821-S27	Eco Shuttle Garage	\$61,797.14	\$0.00	100

821-S28	NOAA Shed	\$25,768.00	\$487.02	98.11
821-S51	Greenhouse Support Shed	\$0.00	\$0.00	100
821-T01	CRC Office Trailer	\$277,524.68	\$56,670.54	79.58
821-T02	SERC Triple-Wide	\$279,882.00	\$57,151.90	79.58
821-T03	SI Construction Trailer	\$236,520.00	\$26,064.50	88.98
821-T04	Citizen Science Trailer	\$157,680.00	\$17,376.34	88.98
821-T05	Residence Trailer	\$148,219.20	\$8,285.45	94.41
823-600	Wetlands Laboratory	\$286,361.26	\$5,956.31	97.92
823-605	Forestry Canopy Shed	\$13,499.54	\$264.59	98.04
823-620	N2O Laboratory	\$220,585.55	\$43,345.06	80.35
823-S60	Wetlands Laboratory Cylinder Storage Shed	\$23,255.62	\$251.16	98.92
823-S61	Wetlands Laboratory Equipment Shed	\$45,600.78	\$5,918.98	87.02
827-651	Cory House	\$1,341,150.00	\$1,710,234.48	-27.52
827-652	Corn Island Well House	\$12,884.00	\$9,851.11	23.54
827-653	Corn Island Garage	\$193,260.00	\$122,043.69	36.85
827-654	Corn Island Barn	\$168,471.18	\$106,389.55	36.85
830-300	Sellman House	\$2,646,169.24	\$255,090.71	<mark>90.36</mark>
830-403	Well House	\$44,802.82	\$7,379.02	83.53
830-407	Composting Toilet Facility 1	\$10,249.59	\$374.11	96.35
830-408	Composting Toilet Facility 2	\$8,993.01	\$328.24	96.35
830-500	Greenhouse and Support North	\$371,059.20	\$7,013.02	98.11
830-501	Greenhouse and Support South	\$371,059.20	\$7,013.02	98.11
830-S32	Security Booth	\$6,676.49	\$0.00	100
830-S50	Garden Shed	\$61,843.20	\$0.00	100
837-001	SMA Antenna Maintenance Building	\$1,576,983.08	\$299,311.39	81.02
837-002	SMA Control Building	\$4,138,620.09	\$503,670.07	87.83
837-003	SMA Operations Headquarters	\$15,046,613.83	\$1,622,024.97	89.22
837-0045	HFTZ Warehouse	\$0.00	\$0.00	100
838-010	Administration Building - Base Camp	\$11,737,246.40	\$350,943.67	97.01
838-011	Mirror Laboratory Equipment Shed - Base Camp	\$32,462.72	\$1,298.51	96
838-012	Multi Mirror Telescope Storage Building -Base Camp	\$630,720.00	\$14,821.92	97.65
838-013	Pump House - Base Camp	\$92,623.54	\$2,185.92	97.64
838-014	Picnic Area Restrooms - Base Camp	\$167,030.84	\$9,704.49	<mark>94.19</mark>
838-015	Flammable Liquid Storage - Base Camp	\$14,626.28	\$321.78	97.80
838-020	Generator Shed - North Ridge	\$162,813.00	\$0.00	100
838-021	Communications Shed - North Ridge	\$36,681.59	\$10,736.70	70.73
838-022	Dormitory - North Ridge	\$3,318,748.98	\$851,922.86	74.33
838-023	Restrooms - Ridge	\$151,381.44	\$18,362.57	87.87
838-024	Support Shop - North Ridge	\$724,402.24	\$93,954.97	87.03
838-025	Pump Shed - North Ridge	\$46,255.44	\$2,705.94	94.15
838-026	APT Support Building - North Ridge	\$1,511,060.10	\$234,516.53	84.48

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838-027	APT Building - North Ridge	\$275,955.75	\$31,541.74	88.57
838-028	APT Communications Shed - North Ridge	\$67,280.64	\$2,213.53	96.71
838-029	HATs Building - South Ridge	\$98,324,35	\$12,211.88	87.58
838-030	60/48-inch Telescope Building - South Ridge	\$2.641,267.95	\$582,135.46	77.96
838-031	PAIRITEL Telescope Building - South Ridge	\$322,790.61	\$62,104.91	\$0.76
838-032	Gamma Ray Building - South Ridge	\$1,838,196.44	\$125,365.00	93.18
838-040	Aspen Pump Shed - Bowl	\$32,980,48	\$8,739.83	73.50
838-050	Restrooms - Bowl	\$112,132.65	\$24,119.73	78.49
838-051	Common Building - Bowl	\$3,057,300.61	\$1,241,875.51	59.38
838-052	Summit Dormitory - Bowl	\$3,075,718.69	\$871,658.68	71.66
838-053	IOTA Control Building - Bowl	\$1,046,259.35	\$115,193,15	88.99
838-059	Instrument Repair Building - Summit	\$531,590.64	\$6,538.56	98.77
838-060	Multi Mirror Telescope (MMT) - Summit	\$14,291,164.65	\$232,945.98	98.37
838-061	Support Shop - Summit	\$2,190,223.24	\$56,945.80	97.40
838-062	Shop Shed -Summit	\$67,411.62	\$1,550.47	97.70
838-063	VERITAS Control Building - Base Camp	\$1,667,479.00	\$39,185.76	97,65
838-064	PSCT Control Shed - Base Camp	\$88,919.60	\$5,753.10	93.53
838-065	VERITAS T1 UPS & Electronics Shed - Base Camp	\$105,204.00	\$3,913.59	96.28
838-066	VERITAS T2 Electronics Shed - Base Camp	\$105,204.00	\$5,649.45	94.63
838-067	VERITAS T2 UPS - Base Camp	\$25,405.60	\$3,727.00	85.33
838-068	VERITAS T3 Electronics Shed - Base Camp	\$105,204.00	\$3,324.45	96.84
838-069	VERITAS T3 UPS - Base Camp	\$25,405.60	\$3,648.24	85.64
838-070	VERITAS T4 Electronics Shed - Base Camp	\$105,204.00	\$2,493.33	97.63
838-071	VERITAS T4 UPS - Base Camp	\$25,405.60	\$525.90	97.93
953-001	Marine Station Main Lab	\$3,635,439.27	\$496,237.46	86.35
953-002	Tyson House	\$436,987.20	\$103,434.87	76.33
953-006	Storage Building	\$630,744.00	\$30,338.79	95,19
953-007	Wet Lab	\$441,532.80	\$12,936.91	97.07
953-008	Rodman Pavilion	\$75,952.09	\$20,074.14	73.57
953-010	Marine Ecosystems Exhibit	\$0.00	\$0.00	100
953-013	Coast Guard Station	\$0.00	\$0.00	100
953-015	Chemical Storage Shed	\$12,614.88	\$1,791.31	85.80
953-017	Storage Shed 1	\$2,911.84	\$122.30	95,80
953-018	Storage Shed 2	\$2,911.84	\$122.30	95.80
953-019	Storage Shed 3	\$2,911,84	\$122.30	95,80
956-001	Alexander Hamilton US Custom House	\$102,426,239.98	\$8,706,230.40	91.50

FCI and SCI Determination: Background and Methodology

In 1996 the Federal Accounting Standards Advisory Board (FASAB)⁴ enacted Standard Number 6, Accounting for Property, Plant, and Equipment (PP&E), the first government-wide initiative requiring federal agencies to report dollar amounts of deferred maintenance annually. The FASAB identified four overall objectives in federal financial reporting: budgetary integrity, operating performance, stewardship, and systems and control. FASAB Standard Number 6, as amended, focuses on operating performance and stewardship. The definition of maintenance (and thus deferred maintenance) in FASAB Standard 6 was revised to better reflect realistic measurement of facility condition. Adopted by the Board in December 2011, the new definitions for Maintenance and Deferred Maintenance are:

"Deferred Maintenance and Repairs (DM&R)

Maintenance and repair activities that were not performed when they should have been or were scheduled to be and which, therefore, are put off or delayed for a future period."

"Maintenance and Repairs (M&R)

For purposes of these standards, maintenance and repairs are activities directed toward keeping fixed assets in an acceptable condition. Activities include preventive maintenance, replacement of parts, systems or components, and other activities needed to preserve or maintain the asset. Maintenance and repairs, as distinguished from capital improvements, exclude activities directed towards expanding the capacity of an asset or otherwise upgrading it to serve needs different from, or significantly greater than, its current use." (Proposed)

The significance of this revision is the recognition of repairs as part of the definition and that any increased capacity or change from "current use" is excluded.

The impact of deferred (unperformed) maintenance on real property is depicted in. Normal appropriate maintenance increases the probability a system (whether static or dynamic) will achieve at least the designer's intended life. Optimum performance can only be achieved when minor degradations are corrected in a timely manner. When degradations go unchecked, the cumulative result drives the system towards the tipping point from which recovery becomes prohibitively expensive. The tipping point occurs when the system reaches functional failure, i.e. minimum acceptable performance is not achievable. Figure 1 provides a facility/system performance model depicting the accelerated degradation due to inadequate maintenance.

⁴ The Federal Accounting Standards Advisory Board was established in October 1990 by the Secretary of the Treasury, the Director of the Office of Management and Budget, and the Comptroller General of the United States. The board was created to consider and recommend accounting standards and principles for the federal government to improve the usefulness of federal financial reports.



Figure 1 – Maintenance Impact on Design Life

The issues for federal facilities have been documented in the report *Stewardship of Federal Facilities: A Proactive Strategy for Managing the Nation's Public Assets* (NRC, 1998) and in the recent report *Predicting Outcomes of Investments in Maintenance and Repair of Federal Facilities* (NRC, 2012). They include:

- A shift in focus from design and construction costs, the so-called first costs of facilities ownership, to life-cycle costs, in the federal budget process
- Inadequate funding for maintenance and repairs
- The risks associated with aging facilities that require increased levels of maintenance and repair to keep them operating effectively
- Lack of information that would assist facilities program managers in making compelling arguments for maintenance and repair budgets to decision makers
- Lack of accountability for stewardship
- More efficient uses of the condition assessment process

SI uses a parametric cost estimating model developed by DoD in the mid-2000s and adapted by NASA. This model documents facility condition and estimates deferred maintenance consistently across an agency's large and varied population of facilities.

Designed to be a simplified approach using existing empirical data, the method is based on:

- Condition assessments performed at the system level rather than the component level which is consistent with SI's Reliability Centered Maintenance (RCM) approach
- A limited number of systems to assess (eight)
- Use of generalized condition levels (five)
- Current (or plant) replacement values (CRV) of the systems and the facility they support

The Deferred Maintenance & Repair Model uses Cost Estimating Relationships (CERs) based on existing engineering data and associated algorithms to establish cost estimates.

For example, a building system (i.e. the plumbing system) value and required repairs that can be developed using costing models such as RS Means[™]. However, if equipment history has demonstrated plumbing system repairs normally cost approximately 25% of the replacement cost, then a detailed estimate is not required, and a repair cost can be computed at the 25% of current system replacement value level.

In brief, the Deferred Maintenance and Repair Method begins with a rapid visual inspection. Assessors rate each of the following eight building systems, from five (Excellent) to one (Functional Failure) for each facility:

- Structure
- Exterior
- Roof
- HVAC
- Electrical
- Plumbing
- Conveyances
- Interior Finishes

Following assessment completion, the system ratings are entered into our Facility Center where the ratings are processed through a parametric estimating model using the current replacement value (CRV) as its basis. The CRV is apportioned among each of the facility systems, using different System CRV Percentage models for each of 38 different facility types.

The Deferred Maintenance and Repair Model produce the following three useful sets of metrics:

- Deferred Maintenance & Repair Cost Estimate (DM&R), a measure that indicates the amount of facilities work which has been deferred for budgetary reasons and is required to restore the facilities to a like new condition
- System Condition Index (SCI), a rating derived from the condition assessment ratings for one of the eight building systems
- Facilities Condition Index (FCI), the sum of the weighted SCI's, providing an overall condition score for each facility

Parametric Estimating

"An estimating technique that uses a statistical relationship between historical data and other variables (for example, square footage in construction, lines of code in software development) to calculate an estimate for activity parameters, such as scope, cost, budget, and duration. This technique can produce higher levels of accuracy depending upon the sophistication and the underlying data built into the model. An example for the cost parameter is multiplying the planned quantity of work to be performed by the historical cost per unit to obtain the estimated cost."

Parametric cost estimating methods are based on physical or performance characteristics and schedules of the end items. The estimate is derived from statistical correlation of historic system costs with non-cost parameters, such as quality characteristics of performance and/or physical attributes of the system.

Parametric estimating relies on simulation models that are systems of statistically and logically supported equations. The impacts of a product's physical, performance, and programmatic characteristics on cost are captured by these equations. The object to be estimated is described by choosing specific values for the independent variables in the equation which represent the characteristics of the object. The equations are then used to extrapolate from past and current experience to forecast future cost.

Facility Systems

Generally following UNIFORMAT II Classification for Building Elements, each cost model contains eight facility systems.

- Structure: foundations, superstructure, slabs and floors, and pavements adjacent to and constructed as part of the facility (i.e., sidewalks, parking lots, access roads)
- Exterior: wall coatings, windows, doors, and exterior sealants
- Roofing: roof coverings, openings, gutters and flashing
- HVAC: heating, ventilating and air conditioning systems, including controls and balancing devices, and other mechanical equipment associated with indoor air quality
- Electrical Systems: electrical service and distribution within five feet of the facility, lighting, security, and fire protection wiring and controls
- Plumbing: water, sewer, fire protection piping, piping for steam, gas, and water distribution in specialty systems (e.g., tanks, generation plants, etc.)
- Conveyances: elevators, escalators, cranes and other lifting mechanisms
- Interior: all interior finishes including wall coverings, flooring, and ceilings

Originally a ninth system was included: <u>Program Support Equipment</u>. This system included test, research and specialty equipment permanently affixed to the facility to provide support for research programs (e.g., additional ventilation equipment or separate HVAC systems required only to support special testing or programs).

During the course of the 2007 survey, this ninth system was eliminated as it had: 1) limited use; 2) was often associated with equipment that was in the facility but funded and maintained by others (e.g. equipment in support of telescopes, research equipment and antenna), and 3) it did not fit as a UNIFORMAT system element. At present, only the eight building systems are assessed as any program equipment is usually funded from non-federal outside sources.

There is discussion regarding breaking out these eight systems into more detail which would help focus where the specific deficiencies lie, but this would also increase the complexity of the assessment process.

Facility System Replacement Value

SI uses Current Replacement Value (CRV). However, some agencies use Plant Replacement Value (PRV). They are defined as follows:

<u>CRV</u>⁵ – Current replacement value is defined as "the actual cost of replacing the facilities...not the book value" and "the total expenditure in current dollars required to replace a facility...[to] meet current acceptable standards of construction and comply with regulatory requirements."

⁵ APPA: The Association of Higher Education Facilities Officers. *The Strategic Assessment Model*. Alexandria, Virginia: APPA 1999 & 2001.

PRV⁶ - Plant Replacement Value (PRV) is the cost, in current year dollars, to design and construct a notional facility to replace an existing facility at the same location. The notional replacement facility will perform the same functions as the existing facility, within the same capacity as calculated in the assigned Facility Analysis Code (FAC) primary unit of measure. The notional replacement facility will also be constructed to current standards of materials and design consistent with Federal guidelines. PRV is a macro value, valid across an inventory of facilities, and does not represent the actual construction cost to replace a single existing facility. Additionally, PRV is only associated with existing real property assets and does not address current or new mission deficits or capacity shortfalls. However, the value of PRV can be projected into the future using an asset quantity, other formula elements, and the appropriate inflation adjustment.

CRV and PRV for a single facility does not include the costs for land acquisition, site preparation, earthwork, landscaping, supporting facilities, associated facilities, or studies/surveys outside normal planning and design.

In some cases, a facility may not be owned by SI, but we may have responsibility to maintain and replace key components. This is the case for the Alexander Hamilton U.S. Customs House in New York City and the U.S. Postal Museum. These buildings are owned and maintained by GSA and are partially occupied by SI. However, because of the function of the buildings SI may have responsibility for the mechanical and electrical systems in the building or the portion of the building that is solely dedicated to SI. The CRV for these buildings reflect only the systems/space that is SI's responsibility.

Since 2007, annual adjustments have been made to each base CRV based upon annual construction cost changes using the ENR Building Cost Index (BCI). This index is furnished each year by Office of Planning Design and Construction (OPDC) Facility Investment and Cost Engineering (FICE).

Another major adjustment made in the establishment of the CRV for the museums and buildings on the D.C. Mall was the adoption of the unit cost estimate for the construction of the National Museum for African American History and Culture (NMAAHC) developed by Freelon Bond⁷ in September 2008. This resulted in a base number of approximately \$900/GSF, inflated to over \$1000 in today's dollars, which has been used for all Mall museums and the DWRC.

Also used for the calculation of CRV is the constructed GSF. In some cases, the GSF differs significantly from the square footage reported in SI Explorer and in the FRPP. This is also based upon an APPA standard and reflects volume of the building. In some cases, the Rentable Square Footage was used rather than the GSF (NMNH, NMAH, NMAI-CRC, MSC, NPM, A&I, Udvar-Hazy, and Renwick).

⁶ Report of the Plant Replacement Value (PRV) Panel *Office of the Deputy Under Secretary of Defense* (*Installations and Environment*) August 2001 – May 2003

⁷ Davis Brody Bond and the Freelon Group Architects, Initial Cost Estimate, 2008

Facility System CRV Distribution (Facility Category Codes)

The Category Codes group facilities whose systems are similar and have the approximate relative system CRV percentage values. The main purpose is to allow the distribution of the total facility CRV to the eight systems rated based upon the type of facility and its function and the contribution of the facility system to the total CRV of the facility. These category types are somewhat aligned with the Federal Real Property Council's (FRPC) Real Property Predominant Use Categories.

For example, one category may be administrative buildings. These are facilities that function like office buildings, and have a structure, roof, exterior, interior finishes, and typical mechanical systems (HVAC, electrical, and plumbing). Another category may be laboratories. Laboratories have the same systems as an administrative building, with a structure, roof, exterior, interior finishes and mechanical systems, but their percent contribution to the CRV will be different (more heavily weighted toward electrical and HVAC), so these building types need to be separate in the DM&R Model. Other facilities such as museums, collection storage, open storage, and other structures have correspondingly different cost models for purposes of estimating DM&R.

The Category Codes may require further adjustment based on the building configuration. For example, Admin Buildings (Category 5) may be a single story or multi-story building. If the building is single story and there are no conveyance systems (e.g. elevators) in the building, this system would be scored as "0". However, Category 5 has a 3% distribution for conveyances; therefore, this 3% would need to be allocated to some other system and is typically added to "Structures." Depending on the type of use of the facility, the assessor may choose to add this percentage to another system that he/she feels needs to be increased (possibly to HVAC if there is a food service component within the facility). This is a judgment call made at the time of the compilation of the scores and requires knowledge of overall building systems and their criticality to the purpose and function of the building.

The 38 DM&R Category Codes are shown in Table 6, include the most applicable FRPC Real Property Index (RPI).

	DM Category Facility System CRV %									
Facility Type	DM Class	Structure	Exterior	Roof/Cage	HVAC	Electrical	Plumbing	Convey	Interior	RPI Use Category
Admin Bldgs	5	19%	17%	6%	16%	18%	5%	3%	16%	10.0
Training Bldgs	6	18%	20%	5%	12%	21%	5%	1%	18%	10.1
Substation	16.2	10%	7%	0%	0%	83%	0%	0%	0%	15.1
Storm Drains	18.2	90%	0%	0%	0%	5%	5%	0%	0%	18.0
Museums	25.1	20%	15%	12%	10%	15%	11%	2%	15%	28.0
Exhibit Enclosures - Large Animals	24.2	40%	10%	4%	4%	10%	20%	0%	12%	29.1
Exhibit Enclosures - Small Animals	24.3	25%	10%	4%	15%	20%	15%	0%	11%	29.2
Animal Barn/Shed	24.4	65%	10%	10%	5%	5%	5%	0%	0%	29.3
Greenhouses (Not Cond)	25.3	70%	15%	0%	0%	5%	5%	0%	0%	29.4
Food Service/Rest.	25.6	20%	15%	10%	15%	15%	10%	0%	15%	29.5
Security - Vehicle Access	25.7	30%	15%	15%	10%	25%	0%	0%	5%	29.6
Security Guard Booth	25.8	40%	15%	15%	10%	15%	0%	0%	5%	29.7
Housing	29	15%	17%	9%	16%	17%	7%	0%	18%	30.0
Berthing & Housing (Open)	29.1	50%	0%	0%	0%	10%	40%	0%	0%	31.0
Storage Bldgs	8	60%	15%	10%	4%	6%	1%	0%	4%	40.0
Storage Bldgs (Not Cond)	8.1	65%	20%	10%	0%	5%	0%	0%	0%	40.1
Utility Building	16.1	60%	15%	10%	5%	5%	3%	0%	2%	50.0
HVAC Dist	17	30%	10%	0%	0%	33%	27%	0%	0%	50.1
HVAC Generation	17.1	20%	10%	5%	35%	10%	15%	0%	5%	50.2
Waste Water Treatment	18.1	37%	10%	5%	0%	15%	33%	0%	0%	50.3
Potable Water Treatment	19.1	40%	5%	5%	0%	15%	25%	0%	10%	50.4
Potable Water Distribution	19	38%	5%	2%	0%	5%	50%	0%	0%	50.5
Compressed Air Gen	27	50%	0%	0%	0%	10%	40%	0%	0%	50.6
Maintenance Facility	23	20%	14%	6%	13%	30%	9%	0%	8%	60.0
O&M Facilities	23.1	20%	14%	6%	13%	28%	9%	2%	80.8	60.1
Restrooms - Public	24.1	17%	10%	5%	3%	20%	30%	0%	15%	60.2
Antenna	1.1	60%	10%	0%	0%	30%	0%	0%	0%	65.0
Electrical Dist Sys	16	39%	3%	0%	0%	58%	0%	0%	0%	71.0
Waste Water Collection	18	50%	2%	2%	0%	5%	41%	0%	0%	71.1
R&D Structures (Labs)	2	40%	17%	6%	6%	25%	2%	1%	3%	74.0
R&D/Test Bldg	1	18%	19%	4%	15%	20%	4%	15%	1%	74.1
OtherBldgs	24	20%	15%	12%	10%	15%	11%	2%	15%	80.0
Other Struc	25	71%	10%	2%	5%	10%	1%	0%	1%	80.1
Piers/Docks	25.2	80%	15%	0%	0%	5%	0%	0%	0%	80.3
Open Structures	25.4	80%	0%	10%	0%	5%	5%	0%	0%	80.5
Greenhouses (Cond)	25.5	55%	10%	10%	10%	5%	5%	0%	5%	80.6
Prefab Bldg	28	15%	17%	9%	16%	18%	7%	2%	16%	80.7
Trailers	7	20%	19%	6%	18%	20%	2%	0%	15%	

Table 6 – Facility Category System CRV Percentage Distribution

Condition Criteria

SI uses a five-tier condition rating system where "0" denotes a facility system that does not exist for that facility (e.g. buildings with no elevators or finished interiors). The established deferred maintenance assessment guidelines require assessors to consider age as a rating factor for HVAC and electrical systems.

In some cases, very old facilities have been completely or partially renovated, thereby rendering the facility age unimportant. In other cases, it is apparent that major facility renovations have not occurred within the facility. Assessors should downgrade HVAC and electrical systems by one rating level if systems are 20-30 years old. Systems installed more than 30 years ago are to be downgraded by two rating levels.

For example, if a system appeared to function properly, and by visual inspection required nothing more than normal maintenance, (a "5" per criteria), but was on aggregate more than 30 years old, it is to be rated a "3," rather than a "5." However, no rating will be lowered below a rating of "2" solely for age. This adjustment addresses the need to program replacements for aging, obsolete, and potentially dangerous electrical and mechanical systems.

Table 7 describes the five tiers from Excellent (meets 100% of Design Intent for current use) (5) to Bad (functionally failed) (1) in general terms. Specific details regarding the rating of each system is included towards the end of this report.

Table 7 – Condition Rating Criteria

5	Excellent Normal preventive maintenance required.
4	Good Some minor repairs could be required. Safe to use, meets all codes.
3	Fair More minor repairs required. Wear and tear noticeable. Meets most codes.
2	Poor Significant repairs required. Broken elements. Wear and tear excessive.
1	Bad Replacement required. Unsafe to use.

System Condition CRV Percentage

A significant component of the DM&R estimate is the application of a System Condition CRV Percentage based on the assigned condition rating for each facility system.

Each condition rating has a corresponding System Condition CRV Percentage which varies based on the facility system.

The System Condition CRV Percentage increases as the condition of the facility system gets lower ratings, creating a larger DM&R estimate.

For example, if the structure of a facility receives a 5 rating, its contribution to DM&R is 0% because there is typically no deferred maintenance for this rating. However, if the structure received a 3 rating, its contribution to the deferred maintenance will be 10% of the CRV of the facility.

Continuing with the example, in the same facility, a 3 rating for the electrical system will contribute 13% of the CRV to the DM&R, or the plumbing system with a 2 rating will contribute 57% of the CRV to the DM&R.

Using RS Means[™], the System Condition CRV Percentage values were developed by comparing cost estimates for various levels of facility system repair work to cost estimates for facility system construction. This allows the calculation of Deferred Maintenance to consider a "degree of significance" for the severity of deterioration for each system. These comparisons, expressed as percentages, translate into the System Condition CRV Percentage which is shown in Table 8.

Table 8 – System Condition CRV Percentage vs. Condition Code

System Condition CRV %							
	Condition Rating						
System	5	4	3	2	1		
Structure	0	1	10	25	150		
Exterior	0	1	10	.50	101		
Roof	0	9	38	75	150		
HVAC	0	2	13	63	133		
Electrical	0	2	13	63	133		
Plumbing	0	2	10	57	121		
Conveyance	0	2	13	50	100		
Interior	0	1	10	50	101		

For seven of the systems, a rating of 1 result in a deferred maintenance amount greater than the CRV. The additional cost is due to demolition and disposal expenses.

Historical preservation and restoration are handled on a case by case basis as they require the preparation of a detailed inspection by specialists.

DM&R Calculation

The facility DM&R estimate is the sum of the deferred maintenance estimates of the eight facility systems.

The DM&R estimate is calculated by first determining the Facility System CRV by multiplying the Facility CRV by the Facility System CRV Percentage.
Next, based on the Condition Rating for each of the facility systems, the corresponding System Condition CRV Percentage is multiplied by the Facility System CRV. The product is the DM&R estimate for each facility system. These are summed to obtain the facility DM&R estimate.

The following are the steps required to calculate the deferred maintenance for each of the eight systems:

- 1. Calculate total facility CRV by multiplying the Square Footage times the unit cost (as determined from above)
- 2. Determine the most appropriate Facility Category that fits the facility and make any necessary adjustments due to configuration
- 3. Distribute the total CRV (Step 1) by the percentage distribution for the Facility Category (Table 7) to the eight (or fewer) systems
- 4. Using the ratings for each system (Table 8), determine the appropriate condition factor for that rating and system (Table 9)
- 5. The DM&R for each system is the product of steps 3 and 4
- 6. The Facility DM&R is the sum of all system DM&R's as calculated above

For example:

Assume a 200,000 GSF office building (Category 5 – Administrative) with a unit CRV of \$400/GSF and a Roof rating at a condition of 3 (Fair). The DM&R for the roofing system for this building would be:

- 1. Building CRV = 200,000 X \$400 = \$80,000,000
- 2. Roof CRV = \$80,000,000 X .06 = \$4,800,000 (From Table 6, DM&R Category 5, 6% for Roof)
- 3. Roof DM&R = \$4,800,000 X 0.38 = \$1,824,000 (From Table 8, Roof Condition 3)

In this example, a building this type, size, unit CRV, and with the roof in "fair" condition, \$1,824,000 of deferred maintenance was generated. This would represent, in a dollar amount, the amount of deterioration that has occurred to the roof over the years, or a representative amount that would have to be invested in repairs/maintenance to the roof to restore it to a good condition.

SCI and FCI Calculations

The System Condition Index (SCI) calculation determines the condition of a specific facility system across a group of facilities. It can be calculated at the Facility, Zone and/or Institution level to identify which of the eight facility systems is in greater need of repair and assist in prioritizing facility systems projects for multiple facilities. The Facility Condition Index (FCI) is the average of all the facility SCI's.

SCI is calculated by first determining the CRV of the facility system in question by multiplying the Facility CRV by the Facility System CRV Percentage. The value of these Facility System CRV's are then added to obtain the Total System CRV.

Next, the System CRV for each facility is normalized or weighted by dividing the System CRV by the Total System CRV. This quotient is then multiplied by its respective Condition Rating.

These individually "weighted" System Indices are then added together to determine the SCI.

The Facility FCI calculation weighs each of the eight system condition ratings by its associated Facility System CRV Percentage based on the Facility Category.

For each system, the Condition Rating is multiplied by its Facility System CRV Percentage to get a weighted value. The sum of the eight weighted values equals the facility's FCI.

The SCI and FCI calculations are performed as follows:

SCI = [1 – (System DM&R/System CRV)] X 100; and,

FCI = [1 – (Total DM&R/Facility CRV)] X 100.

Zone FCI Calculation

The Zone FCI is calculated by dividing the Zone DM&R value by the Zone CRV. The same calculation is applied to facility groupings at the Zone and Institution level. Also, with facilities that have multiple buildings and structures such as NMNH, NPZ, CRC-Front Royal, SAO, STRI and SERC, the calculations are at the individual building level but summarized at the facility and site level.

Zone SCI's and FCI's are shown in *Table 4* in the *Summary and Findings* Section of this report.

FCA Database

Built from appropriate data fields from the SI Real Property Inventory (RPI) database, the FCA database processes facility system condition ratings through the calculations cited earlier to generate facilities metrics for each facility system, facility, Zone, Offices, Programs, and Institution.

DM&R estimates per system and for the total facility, Facility Condition Indexes (FCI) per system and for the total facility, and System Condition Indexes (SCI) should be recalculated annually incorporating changes in real property assets, the value of the assets, and the condition of the assets.

The DM&R database information can be sorted by facility, types of facilities, condition rating, etc., providing a robust management tool with which to more effectively identify needs and focus resources to improve the condition of critical assets.

This year the report was generated completely from Facility Center (FC), our CMMS. Field data was directly inputted into the system and exported when needed for this and other reports. OCIO, Office of Chief Information Officer, were integral in creating standard reports that could be ran whenever needed. In past years, this database was maintained in Excel format as a stand-alone database. During 2012, a substantial effort was made to convert and load the data into SI's centralized maintenance management system – Facility Center, version 10. From here forward, FC will be the principal tool for processing and calculating FCA data.

Knowledge Based Assessment

Up until this point in time the process has been to physically assess all facilities every three years and to perform "desk audits" in the interim years. The interim year updates are done primarily to meet the reporting requirements of the Federal Real Property Profile which requires an annual reporting of CRV and FCI. The three-year cycle is somewhat arbitrary as it is driven by resource availability and the time required to physically assess the 600 plus facilities located throughout the U.S. and Panama.

The current trend among several federal agencies (i.e. DOD) is to develop a knowledge-based approach to condition assessment. This approach determines when an assessment is performed based upon risk and at what point a facility or system is in its economic life cycle. Referring to Figure 1, above, facilities and systems do not deteriorate over time in a linear fashion. Once a facility/system is installed and properly commissioned (a key element) there is a period that the asset will perform closely to, or at its design intent, provided that routine maintenance is performed. However, at some stage in its life, for various reasons, the rate of deterioration will increase and will continue to increase to the point of functional failure. A Knowledge Based Assessment (KBA) approach recognizes this non-linear deterioration rate and adjusts the condition monitoring and assessment of this asset to best assess the condition with enough lead time to properly plan and budget for the repairs or upgrades before performance is seriously impacted. Added to this is the factor of risk – or criticality. The more critical an

asset is to the mission of the Smithsonian the higher the risk of serious impact to the mission. Some federal agencies (e.g. DOD) have developed a Mission Dependency Index that assigns a criticality factor at both the facility level as well as to systems within the facility.

One of the difficulties with this approach is that there is no set, standard timeline deterioration rate that can be applied over like facilities/systems. Variables such as usage, operation practices, environment and basic quality of equipment when installed all impact this time/performance relationship. This highlights the need to have an integrated information system that can track performance trends and monitor how an asset is functioning over time – to be predictive and provide future forecasting so that proper planning, programming, design, and repairs can take place before functional failure occurs. In addition to the parametric assessments, all assets need to be integrated into a common database that tracks condition, ongoing maintenance, and repairs so that at any point in time an accurate picture of the assets' conditions can be determined, and future rates of deterioration projected.

Implementing this system will be labor intensive up front as information needs to be manually entered but the long run payoff will be a more precise system to forecast budgets and allocate resources such as focusing assessments on the highest risk facilities and systems rather than a blanket and arbitrary 3-year timeline. Depending upon the risk of failure (criticality) and where the facility/asset is on its life/performance cycle, an assessment may not be needed. However, for high risk assets that are at a late stage in life, assessments may be required more frequently. All of this can be driven by an interactive database that links asset condition, age, performance, and maintenance and repairs performed, to produce requirements that will generate detailed prioritized, risk-calculated projects that restore a system's functionality back to the original design intent (an example of this is the BUILDER concept, we are currently trying to develop Facility Center to assist in this effort).

System Specific Condition Criteria

This Appendix describes the criteria to be used in assessing each of the nine systems. Although Program Equipment was not included in both the 2007 and 2010 assessments, it is included here as it may be used in future assessments.

Structure Assessment

For traditional buildings, the assessment of STRUCTURE includes the foundation, and structural integrity of walls, floors, stairwells, and loading docks.

For non-traditional buildings (antennas, tanks, pads, etc.), STRUCTURE involves assessing the slab, supporting members, and adjacent pavements of the facility. Assess STRUCTURAL integrity of:

- Walls
- Floors
- Stairwells
- Loading docks
- Pavement sidewalks, roads, including seal coat
- Equipment slabs antennas, tanks
- Steel framing columns and beams

For most facilities, STRUCTURE includes the paved areas

immediately (within five feet of the facility) surrounding the facility, including sidewalks and parking lots. When rating STRUCTURE the assessor must consider the relative value of the paved areas compared to the overall facility. For smaller facilities, the paving may constitute a larger percentage; in this case, the paving condition should play a larger part of the structural rating for that facility. For very large and high value facilities, the paving is typically a lower percentage, and therefore will have less impact on the overall STRUCTURE rating assigned.

Assessments of paving should focus on the pavement structure — deep cracking or settling would indicate a sub-surface failure and dictate a more expensive repair. Pavement surface, (e.g. seal coating of asphalt pavements), is also assessed under STRUCTURE.

The following table should be used to determine which condition code to apply to the structure:

5	Excellent Only normal preventive maintenance required.
4	Good Some minor repairs could be required. Does not affect structural integrity or intended use.
3	Fair Cracking, crazing, and/or visual defects. Could affect structural integrity or intended use.
2	Poor Visible settlement, structural defects, significant repairs required.
1	Bad Unrepairable, replacement required.

Exterior Assessment

The EXTERIOR rating includes the wall coverings (e.g., paints, rust proofing, and stucco), sealants, doors, and windows, (including caulking at expansion joints, doors, and windows).

For metal structures, corrosion control is an element of the EXTERIOR rating. Assessors must be careful not

exterior applications must be distinguished. The rating for EXTERIOR must be based upon the entire facility appearance and condition. Some facilities contain multiple additions or have differing conditions on different facedes due to weather

facilities contain multiple additions or have differing conditions on different façades due to weather or aesthetic considerations.

to confuse exterior and structural ratings; evidence of structural cracking vs. cracking in stucco or other

The age of windows and doors can be a consideration in the rating for exterior. Many older SI facilities still have single pane, low efficiency windows and doors.

EXTERIOR can be downgraded one level if the volume of older, less efficient windows and doors is significant.

For some non-traditional facilities, the exterior system is not rated (e.g., electrical distribution systems).

The following table should be used to determine which condition code to apply to the facility exterior:

5 Excellent Only normal preventive maintenance required.
4 Good Some minor repairs could be required. Sound and weatherproof.
3 Fair More minor repairs required. Wear and tear visually noticeable. Not completely sound and/or weatherproof.
2 Poor Significant repairs required. Not sound and/or weatherproof.
1 Bad Unrepairable, replacement required.

Assess EXTERIOR façade for:

- Walls
- Windows
- Doors
- Exterior finishes (paint, stucco, metal panels)
- Caulking at expansion joints, doors and windows

Roof Assessment

Assessors can anticipate many different roof types (e.g., built up, rubber membrane, metal seam) throughout.

Ratings should consider the amount of problems identified. The criteria suggest assessors should look for positive drainage. If ponding exists on a roof, one isolated incident on a large roof should not dictate a reduction in the rating; such a problem would need to be more widespread before reducing the rating.

Metal seam roofs may not show signs of prior maintenance. These roofs usually leak at their seams, and repairs may be affected from underneath the roof. When assessing metal seam roofs, the assessor will need to check for evidence of leaks from within the facility or inquire about past problems during the assessment.

Rubber membrane and built up roofs will show signs of aging and weathering, and roof patches will be visible to indicate past failures of portions of the roof. A visual assessment from atop theses roofs should provide adequate evidence to support a condition rating. Roofs covered in rock need to be walked and checked for evidence of bubbling or cracking.

Assessors can gauge the integrity of the roof by the feel underfoot (check for air pockets, bubbling, or soft spots). For ROOFS with very low ratings, one should expect to see visual evidence or hear reports of leaking within the facility.

Although the age of the roof should be considered (especially for built up roofs), assessors should not arbitrarily reduce the ROOF ratings due solely to age. In older buildings, it is likely that the roof is not original, and therefore the age of the building should not be a criterion when assessing the ROOF.

The following table should be used to determine which condition code to apply to the facility exterior:

5	Excellent Only normal preventive maintenance required.
4	Good Some minor repairs could be required. Watertight, sound flashing and penetrations, positive drainage.
3	Fair More minor repairs required. Mostly watertight.
2	Poor Significant repairs required. Not waterproof. Obvious evidence of leaking from interior assessment.
1	Bad Significant leaking, deteriorated, requires entire re- roof.

- Roof covering
- Roof openings
- Gutters
- Flashing

HVAC Assessment

The HVAC system includes all equipment associated with air movement, heating, or cooling within the facility. For simple facilities, it may consist of roof mounted, wind driven exhaust fans.

Assessors should consider the overall condition of the systems, assessing a representative sampling of systems throughout the facility.

Assess HVAC system for:

- Supply / exhaust fans
- Individual A/C window units, DX units, heat pumps
- Controls
- Chillers
- Boilers
- Steam and condensate piping only if fed from within the building; not from a central plant

Steam or condensate piping within a facility that is fed from a central plant should be rated under PLUMBING. If the steam or condensate are fed from a dedicated system within the building, then all HVAC components are assessed under HVAC.

Assessors should look at the overall condition of equipment. If a majority of HVAC system equipment is more than 20 years old, ratings should be lowered by one level. If most of the equipment is more than 30 years old, ratings should be lowered by two levels.

Assessors must exhibit judgment when rating HVAC systems, focusing on the condition of higher value, larger system components (e.g. chillers.).

Assessors should also evaluate the automated digital controls (if present) of HVAC systems. Older systems may not have any or may have obsolete digital controls. This should be a factor in the overall rating.

Non-traditional facilities may not have HVAC systems, and should receive a zero rating for this system.

The following table should be used to determine which condition code to apply to the facility HVAC:

5	Excellent Only normal preventive maintenance required. Equipment room clean and neat.
4	Good Some minor repairs could be required.
3	Fair More minor repairs required. Some signs of corrosion, leaking, alarms indicators and poor housekeeping are obvious.
2	Poor Significant repairs required. Not functioning as intended. Obvious poor housekeeping and maintenance practices due to excessive corrosion, leaking, or alarm indicators. Does not meet all codes. Obvious age issues and problems getting replacement parts.
1	Bad Nonfunctional, system unrepairable, complete replacement required. System unsafe and does not meet codes.

Electrical Assessment

The ELECTRICAL system includes all transformers, switch gear, distribution systems, panels, and lighting within a facility.

It also includes electrical components of security, communication, and fire protection systems.

Assessors should focus on the condition and appearance of required maintenance or repairs within the ELECTRICAL systems.

Assess ELECTRICAL system for:

- Service and distribution
- Lighting
- Branch wiring
- Communications
- Security
- Fire Protection

Age is a significant factor in rating ELECTRICAL systems. Those that are more than 20 years old should receive a downgrade of one level. Those that exceed thirty years should receive a downgrade of two levels.

The assessor must not arbitrarily judge the ELECTRICAL system based upon the age of the facility; he or she must visually assess a representative sampling of equipment to determine its age and condition.

Less complex facilities may have very little electrical service. Some storage facilities may have no electrical service and should have a zero rating for this system.

The following table should be used to determine which condition code to apply to the facility electrical:

5	Excellent Only normal preventive maintenance required.
4	Good Some minor repairs could be required. Meets code.
3	Fair More minor repairs required. Mostly functional.
2	Poor Significant repairs required. System not fully functional for buildings intended use. Systems obsolete. Does not meet all codes. Age issue a factor here too.
1	Bad Unrepairable, replacement required. Repair parts not available. Systems do not meet code and are unsafe.

Plumbing Assessment

PLUMBING includes all piping conducting fluids within the facilities.

Typically, it includes water, condensate, and sewage piping, but it may also include piping for specialized fluids and gases.

Assessors should look for obvious signs of leaks or prior repairs in these systems.

Assess PLUMBING system for:

- Potable / Non-potable water systems
- Sanitary sewer and septic
- Bathrooms
- Fire Protection piping
- Water treatment systems
- Distribution piping, pumps, valves, etc.
- · Specialized fluids and gas distribution systems

For traditional facilities, PLUMBING also includes the fixtures within restroom and shower facilities. The PLUMBING system can be downgraded one level based on the age and condition of piping and fixtures in these areas.

Insulation or other coatings should be considered a part of the piping itself. Deteriorated coatings can contribute to downgrading of the PLUMBING system.

PLUMBING is harder to assess, as it is often hidden. General questions should be asked about the condition of inaccessible infrastructure systems and buried utilities.

The following table should be used to determine which condition code to apply to the facility plumbing:

5	Excellent Only normal preventive maintenance required.
4	Good Some minor repairs could be required. Good fixture and piping appearance, no leaks.
3	Fair More minor repairs required. Wear and tear noticeable.
2	Poor Significant repairs required. Fixtures and plumbing are obsolete. Many leaks and obvious corrosion in piping systems.
1	Bad Nonfunctional, system unrepairable, complete replacement required.

Conveyance Assessment

CONVEYING includes all elevators and escalators, and cranes and hoists that are permanent parts of the facility.

Due to safety considerations, conveying systems typically must be certified annually. If the conveying within the facility is operating the assessors should assume it is certified, and therefore at a minimum should receive no less than a 3 rating.

Conveying systems in abandoned buildings likely are not certified and should receive no higher than a 3 rating.

Assess CONVEYANCE system for:

- Elevators
- Escalators
- Cranes Overhead, Gantry Semi-gantry
- Jib Boom cranes > 10 tons with permanently mounted hoist
- Dock levelers
- Special lifts

Age of conveying systems is a factor, and systems should be downgraded by one level if they are more than 30 years old.

There are many types of stationary cranes throughout. Note that these cranes are considered stationary because they are part of a building or structure even though they have some mobility within the facility.

There are also many cranes that are not part of the facility and have to ability to move from facility to facility for construction and repairs. They are referred to as mobile cranes and are not accessed.

Determine availability and Mean Time between Callbacks

The following table should be used to determine which condition code to apply to the facility conveyance systems:

5	Excellent Only normal preventive maintenance required.
4	Good Some minor repairs could be required.
3	Fair More repairs required, overall conveying system generally functional.
2	Poor Significant repairs required. Does not meet all codes.
1	Bad Existing system not operational and unrepairable, replacement required. Unsafe to use.

Interior Assessment

The INTERIOR rating includes all interior finishes, including flooring, walls, ceilings, and doors.

As with EXTERIOR, the rating for INTERIOR must be based upon a whole building assessment.

Assessors should walk through a representative sampling of interior spaces to judge the age and condition of interior finishes.

Assess INTERIOR system for:

- Floor coverings
- Interior walls
- Ceilings
- Doors
- Stairs

Warehouses and shop facilities do not dictate exceptional interior finishes. Assessors should consider whether the condition and appearance of the interior finishes is appropriate for the intended facility usage.

Many non-traditional facilities will not have INTERIOR spaces. The DM&R Method does not assess the interiors of storage tanks, pressure vessels, or liquid distribution systems. These facilities should receive a zero rating for INTERIOR.

The following table should be used to determine which condition code to apply to the facility interiors:

5	Excellent Only normal preventive maintenance required.
4	Good Some minor repairs could be required. Slight evidence of marring, discoloration, fading or cracking
3	Fair More minor repairs required. Wear and tear noticeable. Mismatched and or broken/damaged flooring, wall coverings or ceilings.
2	Poor Significant repairs required. Broken elements. Wear and tear excessive.
1	Bad Replacement required.

Bld Sq by location	Sum of Gross Area (Sq. Ft.)
Arizona	84,748
California	1,589
District of Columbia	8,230,754
Florida	19,421
Hawaii	25,654
Maryland	2,136,084
Massachusetts	246,668
New Jersey	37,156
New York	397,582
Virginia	2,096,720
Grand Total	13,276,376

Office of Facilities Management and Reliability

Permit Required Confined Space Entry (PRCSE)

8/1/2019

Safety Program Annual Review

Print Name	Date Reviewed	<u>Signature</u>

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Purpose

This purpose of the Permit- Required Confined Space Entry (PRCSE) Program contains requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit-required confined spaces.

This PRCSE program includes all Smithsonian Institution buildings and Office of Facilities Management and Reliability staff; in particular, those staff engaged in work activities which require them to enter PRCS. The goal will be accomplished through effective education, engineering and administrative controls, the proper use of PRCSE equipment, and enforcement of the program. This PRCSE program will be continually improved upon to help prevent falls from occurring.

OSHA Guidelines - The following are derived from the 29 CFR 1910.146 General Industry Standards. Many SI standards are more stringent and must be followed. Refer to SI Safety Manual, Chapter 15 as the SI Program management document

As our workplace contains permit required spaces, the Smithsonian Institution (SI) the employer, is required to inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

Note: A sign reading "DANGER -- PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign.

Note: The SI has numerous confined spaces. These spaces were assessed by a third party, Emergency Response Services in 2008. The confined space assessments can be found on the OFMR Safety "SharePoint" site, and in the "Green" book that was developed for all zones.

<u>1. Roles and Responsibilities</u>

Safety Coordinator (in conjunction with OFMR Safety Office, where applicable) shall:

- Develop and implement a Facility-Specific Confined Space Entry Plan.
- Review and update the Facility-Specific Confined Space Entry Plan to conform to current OSHA standards.
- Ensure compliance with the Plan by periodic inspection of entry sites and canceling permits where unsafe conditions are present that can be effectively abated.
- Ensure Instructor Led (OFMR Staff) Confined Space Entry training is conducted at least every 3 years for authorized entrants and attendants
- Assist work area supervisors with:
 - 1. Providing confined space training;
 - 2. Identification of confined spaces;
 - 3. Identifying confined spaces that require a permit for entry;
 - 4. Labeling Permit-Required Confined Spaces (PRCS).
 - 5. Ensure that the plan is included in specifications of contracted work in the facility.

Assesses the program annually (at a minimum) by review of the permits

Permit Authorizing Individuals –

A permit authorizing individual (PAI) is someone designated by the facility Director or Zone Manager to authorize the PRCSE permit (e.g. Building Manager, Safety Coordinator, USRO supervisor etc.) The PAI shall:

- Review the initiated permit to ensure that appropriate PRCSE safety requirements are in place as required by this instruction.
- Ensures that all portions of the PRCSE permit are completed and signed prior to permit issuance.
- Ensures that all aspects of this program are followed throughout the permit issuance period to include:
 - 1) All PRCSE personnel are suitably trained in the safe operation of the PRCSE permit process.
 - 2) Advise all COTR's and contractors, as well as SI personnel not familiar with the facility, about hazardous conditions related to PRCSE
 - 3) Ensure a copy of the PRCSE permit is provided to the supervisor to be posted at the job site.
 - 4) Provides a copy of the PRCSE permit to the Security Manager and Control Room Operator for the museum or facility, prior to the PRCSE permit being initiated.

The PAI may request the Office of Safety, Health and Environmental Management (OSHEM) to review special hazard situations and recommend mitigating practices or compensatory measures to prevent injuries such as specific lockout/tagout requirements, or special ventilation or other measures necessary to complete the entry

Building managers: shall maintain all cancelled permits for a minimum of one year for required recordkeeping. May be assigned duties as the PAI.

Duties of authorized entrants. All authorized entrants shall:

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;
- Properly use all PRCSE equipment as required to enter these spaces;
- Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space if needed;
- Only the number of entrants necessary to do the task are allowed to enter the space;
- Alert the attendant whenever:
 - 1. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or
 - 2. The entrant detects a prohibited condition; and
 - 3. Exit from the permit space as quickly as possible whenever:
 - 4. An order to evacuate is given by the attendant or the entry supervisor,
 - 5. The entrant recognizes any warning sign or symptom of exposure to a dangerous situation,
 - 6. The entrant detects a prohibited condition, or
 - 7. An evacuation alarm is activated.

Duties of attendants. Each attendant shall:

- Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;
- Is aware of possible behavioral effects of hazard exposure in authorized entrants;
- Continuously maintains an accurate count of authorized entrants in the permit space (using the PRCS Permit) and ensures that the means used to identify authorized entrants identifies who is in the permit space;
- Remains outside the permit space during entry operations until relieved by another attendant;
- Only attend one confined space entry at a time regardless of proximity of another;
- Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space;
- Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions;
 - 1. If the attendant detects a prohibited condition;
 - 2. If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;
 - 3. If the attendant detects a situation outside the space that could endanger the authorized entrants; or
 - 4. If the attendant cannot effectively and safely perform all the duties required in this section;
- Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

- Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:
 - 1. Warn the unauthorized persons that they must stay away from the permit space;
 - 2. Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and
 - 3. Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;
 - 4. Performs non-entry rescues as specified by the employer's rescue procedure; and
 - 5. Performs no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

Duties of entry supervisors. Entry supervisor shall:

- Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;
- Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;
- Terminates the entry and cancels the permit as required.
- Develops the rescue plan, verifies that rescue services are available and that the means for summoning them are operable;
- Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and
- Determines, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

Contracting Officer's Technical Representative (COTR) Responsibility

All Office of Facilities Management and Reliability COTR's shall:

- Ensure, through contractual requirement, that contractors performing work in confined spaces have a confined space entry plan meeting or surpassing the requirements set forth in this document in place prior to entry into any confined space.
- Will be the POC to obtain any permits required to include the PRCSE and any hot work permits that are required
- May be designated in writing as a PAI by the Zone Manager.

Contractors

All outside contractors working in or on the premises of the Smithsonian Institution will be required to follow the procedures set forth in this PRCSE program or their program so long as it meets or exceeds this program. Contractor programs must have been submitted to the authorizing party and approved prior to work commencing. If contractors are working an area that is owned by them for purposes of the project, they may follow their pre-approved PRCS program. If a contractor is working with an OFMR team in an OFMR owned space, they must follow the OFMR PRCS program.

Contractors in the pre-construction meeting will be informed of these requirements as well as the on-site construction rules that apply. In addition to complying with the permit space requirements that apply to all employers, each contractor who is retained to perform permit space entry operations shall:

- Obtain any available information regarding permit space hazards and entry operations from the host employer (COTR) and:
 - 1. Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near permit spaces so that employees of one employer does not endanger the employees of any other employer; and
 - 2. Inform the host employer of the permit space program that the contractor will follow and of any hazards confronted or created in permit spaces, either through a debriefing or during the entry operation
 - **3.** Ensure that all rescue and emergency procedures are in place prior to performing the task.

*NOTE: Under no circumstances will OFMR staff allow the use of any SI owned PRCSE equipment or perform any atmospheric testing for the contracted services.

2. Required equipment

- Authorized entrants who enter a PRCS or a Non-PRCS must wear a full body harness with a retrieval line attached to the center of their backs near shoulder level (Line attachment is not required for Non-PRCS entry).
- The entry supervisor shall ensure the other end of the retrieval line is attached to a mechanical device or a fixed point outside the PRCS. A mechanical device must be available to retrieve an entrant from vertical type PRCS more than 4 feet deep.
- Spaces other than air handlers need to be tested for air quality and additional supplied ventilation may be required.
- Retrieval Extraction equipment to include a tripod and winch system for entry and extraction into the PRCS.
 - Horizontal entries require an assessment to determine the type of equipment necessary for retrieval
- Other equipment may be required such as portable lighting, ladders, inductive voltage testers, and redundant communications systems or procedures.
- Equipment used in permitted entry areas must be designed for use in in these areas; ideally this equipment should be certified as an intrinsically safe design.

3. Confined Space Entry Types

There are two options available for entry into confined spaces. The following is a summary of each and when they would be used:

1. *Reclassified Non-Permit-Required Entry* – this entry is chosen when all hazards can be eliminated without entry into the confined space. Examples would be entry into an air handler to change filters, entry into elevator pits to retrieve a lost item, etc.

*NOTE: If entry is required to eliminate hazards, it must first be treated as a PRCS then reclassified

2. *Permit-Required Confined Space (PRCS) Entry*- this entry is chosen when the hazards, including atmospheric, cannot be eliminated without entry into the confined space. Examples would be entry into the tunnel system underneath NMNH; entry into a steam tunnel or sanitary sewer; etc.

**Alternate Entry* – this entry is only allowed if reviewed and pre-approved by OFMR Safety.

***NOTE:** Atmospheric hazards, even the potential for an atmospheric hazard to be present, cannot exist in order to reclassify a space.

Procedures for Reclassified (Non-PRCS) Entry

A reclassified or non-PRCS entry is one that involves a space that does not contain or with respect to atmospheric hazards, does not have the potential to contain any hazard capable of causing death or serious physical harm. A permit-required space may be reclassified as a non-PRCS under the following procedures:

- When documented analysis (including testing, where appropriate) demonstrates that, for the task involved, the space can be properly reclassified.
- If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be reclassified for as long as the hazards remain eliminated.
- All other hazards can be effectively eliminated from outside the space, (i.e., tag-out, blanking and blinding, double block and bleed, etc.).
- If the hazards cannot be eliminated from outside the space, the space must first be entered under the PRCS Entry Procedure. Then, once the hazards are eliminated, it can be reclassified as a non-permit space for as long as the hazards remain eliminated.

***NOTE:** Control of atmospheric hazards through forced air ventilation does not constitute elimination of hazards.

Entry Steps:

- Initiate the Confined Space Reclassification Form (Appx G).
- Hold a pre-job briefing with all individuals who will be involved in the entry to review the space specific procedure and JHA for the space and job at hand and the reclassification form with pertinent downgraded information to verify that all pre-entry measures have been satisfied.
- **Certify condition of reclassified space** and authorize personnel to enter once the above steps are complete by signing the reclassification form.
- Enter and perform assigned task(s).
 - **Complete the work in the reclassified space** by:
 - Ensuring that all tools and other servicing materials are removed
 - Ensuring all personnel have vacated the permit space and are in a safe location
 - Ensuring that all equipment has been properly cleaned and reassembled or otherwise returned to operational status

*NOTE: If hazards arise within a space that has been reclassified under this section, each entrant in the space shall exit the space immediately. The space shall be re-evaluated to determine whether it must be classified back to a permit space.

• The reclassification form must be maintained for a period of one year by the Building Manager.

Procedure for Permit-Required Confined Space Entry

This procedure is to be used when all the hazards within the space cannot be eliminated without entering the space. This space may contain or have the potential to contain a hazardous atmosphere.

Entry Steps:

- **Identify the required task(s)** and determine that the work cannot reasonably be accomplished without entering the space.
- Notify the Work Management Center (WMC) at (b) (6) , in order to have DC Fire Rescue services on stand-by. It is critical that the WMC be provided with the following information in the event rescue services are needed:
 - The "Numerical Space Designation" located on the Space Specific Form (inside of the green confined space binder) or provided with the Facility Center work ticket
 - The exact physical location of the opening of the confined space (building, room number or adjacent room number, hallway, etc.)
 - The physical location the entrants will be working inside the space
 - Notification of a potential hazardous atmosphere based on the Space Specific Form "Assessed Hazards & Required Personal Protective Equipment" section or specific work to be performed
 - The method of rescue, i.e. tripod/winch or physical entry.
 - The facility entrance that rescue services will be met, if summoned
 - Any other descriptive information pertinent to rescue personnel
 - The following is an example of an acceptable description given to the WMC:



- After all notifications have been made, initiate the Confined Space Entry Permit (Appx D). Ensure the phone number for OPSCC is included on the permit for rescue purposes
- Once this permit is completed and signed by the Building Manager or Zone Manager, copies should be forwarded to the applicable facility's Office of Protection Services and Safety Coordinator, as well as the WMC.
- Form the entry team, including an entry supervisor, attendant and entrant, ensuring that each person has the training, knowledge and skills required to perform the assigned task.
- Hold a pre-job briefing and JHA review with all individuals who will be involved in the entry to review the following items to ensure that the entry is made safely.
 - Tool(s) required along with any special instructions or safety precautions specific to the tool(s)

- Isolation procedures for the equipment involved
- Hazards normally associated with the permit space
- o Hazards associated with the task to be performed in the space
- Symptoms of overexposure to the hazards
- **Identify the potential hazards** that may be presented by the permit space in question. Identify and evaluate the hazards normally associated with the permit space (by consulting the Space Specific Form for the space located in the green binder) and any hazards associated with the task to be performed (by consulting the JHA for the task).
- Identify and assemble the necessary tools and equipment including equipment for testing and monitoring, ventilation, communications, PPE, lighting, barriers and shields, safe access (e.g. ladders) and rescue and emergency first aid. If power tools are to be used in the space, ensure they are properly guarded and connected to a ground fault circuit interrupter (GFCI).
- Ensure retrieval system is in place for self-rescue (if possible). All authorized entrants must wear a full body (Class III) harness and a safety line secured to a suitable retrieval device or anchor point outside the space unless:
 - It would be infeasible to do so
 - It would reduce the level of protection provided to the authorized entrant

If either of those conditions applies, alternative safety measure must be taken. For entries into vertical spaces greater than 5 feet deep, a mechanical retrieval/fall arrest system (i.e. tripod) must be readily available at the opening.

- **Horizontal entries** require assessment prior to entry to determine the type of equipment needed for entry and rescue
- Ensure appropriate PPE is available and worn by all individuals entering the space. Items to be considered include, but are not limited to: hard hat, hearing protection, gloves, eye protection and respiratory protection.
- **Post appropriate warning signs and erect barriers** where necessary to indicate the permit space entry work is in progress and to keep unauthorized personnel out of the area.
- Isolate the space from hazardous energy sources and materials which may pose a hazard.
 - Except where infeasible, the permit space must be removed from service, isolated and completely protected against the release of energy and material into the space by such means as: blanking or blinding, misaligning or removing section of lines, pipes or ducts, a double block and bleed system, tagout of all hazardous energy sources in accordance with SI Lock-out Tag-out Procedures, or blocking or disconnecting all the mechanical linkages.
 - Isolation must be verified before starting work.
- **Perform the required pre-entry testing of atmospheric hazards** to determine whether ventilation is required or, if the permit space was ventilated, to ensure ventilation has been effective and has not introduced an unexpected contaminant into the space.
 - If oxygen (O₂) levels are lower than expected or permitted, or flammable vapor or toxic levels are higher than expected or permitted, repeat the isolation process above and investigate possible sources of contamination. When a permit space has been vacated for lunch or significant break periods (15 minutes or more) the space should be re-tested before re-entry.

- The internal atmosphere of the permit space must be tested, at the appropriate locations (ground level, mid-level, upper level of the space), with a calibrated direct-reading instrument certified for use in hazardous atmospheres for the following conditions in the order given:
 - Oxygen (O₂) content
 - Presence of flammable gases and vapors
 - Potential toxic air contaminants
- The authorized entrant shall be given the opportunity to observe pre-entry testing of the permit space. If re-testing is required, the entrant shall likewise be given the opportunity to review the re-testing. Further, if the entrant has the reason to believe that the evaluation of the space may not have been adequate, the entrant shall have the right to review the testing.
- Purge, inert flush and/or ventilate the permit space as necessary to eliminate or control atmospheric hazards. This step may be taken either prior to or subsequent to pre-entry testing for atmospheric hazards depending on the circumstances. In situations where applied ventilation is required, a ventilation blower shall be set up and operated to supply fresh air to the interior of the space in a positive pressure mode, preferably by blowing fresh air into a bottom man way or opening and allowing it to sweep the space exiting via an upper man way or opening. The ventilation blower must always be in service prior to and remain in service during entry into the space. Where the internal atmosphere of the space must be approved for use in hazardous atmospheres.
- Certify condition of permit space and authorize personnel to enter once the above steps are complete. This certification and authorization are performed by the entry supervisor and will be posted in full view outside the permit space. The entry supervisor will retain a copy of the signed permit until the entry is terminated.
- Locate the nearest VoIP telephone or obtain a direct phone number to the Office of Protection Services Central Control (OPSCC) in order to obtain rescue services, if necessary. If a VoIP phone is to be used to summon rescue services, 911 shall be called. If a VoIP phone will not be used, the direct phone number to OPSCC shall be used to summon rescue services.

Warning!!!- It is imperative that these procedures be followed in order to properly notify OPS, allowing for the coordination with and direction to Rescue Operations Personnel once they arrive on the scene.

- **Once granted permission** from the entry supervisor, the entrance into the space shall proceed. The authorized entrants should confirm the existence of acceptable entry conditions and begin work on <u>only</u> the authorized task(s).
- **Monitor entry activities.** The attendant, with assistance of appropriate equipment, is responsible for continuously monitoring the entrant(s) and conditions and activities inside and outside the space.
- Complete the work in the permit space by:
 - o Ensuring that all tools and other servicing materials are removed
 - o Ensuring all personnel have vacated the permit space and are in a safe location
 - Ensuring that all equipment has been properly cleaned and reassembled or otherwise returned to operational status

• Terminate the Confined Space Entry Permit. The entry supervisor should confirm that the above steps have been completed by signing the permit. The entry supervisor <u>MUST</u> notify the WMC (b) (6) (b) that the entry is complete. The signed permit should then be forwarded back to the Permit Authorizing Individual (PAI) and to the Building Manager. The permit should be maintained for at least one year, in order to comply with Chapter 15 of the OSHEM Safety Manual.

4. Rescue and emergency services (Self Rescue, On- and Off-DC Mall Area)

Hierarchy of PRCSE Rescue

- A. Self-Rescue Is the preferred method of rescue as the workers have the ability to evacuate themselves to a safe location.
- B. Assisted Rescue Involves rescuers who do not enter the PRCSE but use equipment or procedures to assist the entrant in safely exiting the PRCS. Assisted rescues should be designed such that the rescuers are not exposed to hazards of the PRCS. This method is often used when the fallen worker is partially incapacitated but still able to attach themselves into the rescue system.
- C. PRCSE Rescue Is the most technically complex method of rescue and least desirable as it put rescuers at direct risk. A rescuer must enter the PRCSE to evacuate the injured worker from the space. This is often required because the victim may be unconscious or incapacitated. Due to its technical complexity and risk, PRCSE rescue must be conducted by trained and qualified persons only.

Self-Rescue by Smithsonian Personnel

Self-Rescue is only used in a situation where the entrant/s are able to safety remove themselves from the PRCS. Should this be necessary, the attendant shall assist as needed and immediately notify the entry supervisor. The entry supervisor must notify the Building Manager and OFMR Safety. All parties must not re-enter the space until the space/work has been assessed, all hazards have been eliminated or controlled and another permit is issued/signed by the entry supervisor.

Rescue Procedures – Non-Entry and Confined Space Entry-Rescue (On-Mall Facilities)

If an entrant-turned-victim needs rescue, rescue services must be summoned using a VoIP phone or calling OPSCC from a cell phone. At no time should any OFMR employee enter the space for rescue purposes. If the victim can be safely removed utilizing the wench/tripod system, the attendant or entry supervisor may attempt to rescue by non-entry means only. If prior to nonentry rescue, the monitor is reading an IDLH, all parties must remain at a safe distance to prevent them from becoming victims as well. Under no circumstances shall an OFMR employee enter a permit space with a known IDLH atmosphere.

Most confined space entries within OFMR involve the use of a tripod/winch and a full-body harness tethered together to provide rescue through immediate retrieval of an employee occupying a confined space. However, this type of retrieval is not always possible due to the configuration of the permit space. In these situations, one or more personnel may be required to bodily enter the permit space to extract the entrant-turned-victim. In this case, the following procedures apply.

Notification of Work Management Center Prior to Confined Space Entry

- If entry is required into a permit-required confined space that is not able to be reclassified as non-permit-required, it is imperative that the confined space entry supervisor notify the Work Management Center (WMC) at (b) (6) , in order to have DC Fire Rescue services on stand-by. It is critical that the WMC be provided with the following information in the event rescue services are needed: 1. The "Numerical Space Designation" located on the Space Specific Form (inside of the green confined space binder) or provided with the Facility Center work ticket.
 - 2. The exact physical location of the opening of the permit space (building, room number or adjacent room number, hallway, etc.).
 - 3. The physical location the entrants will be working inside the space.
 - 4. Notification of a potential hazardous atmosphere based on the Space Specific Form "Assessed Hazards & Required Personal Protective Equipment" section or specific work to be performed.
 - 5. The method of rescue, i.e. tripod/winch or physical entry.
 - 6. The facility entrance that rescue services will be met, if summoned.
 - 7. Any other descriptive information pertinent to rescue personnel.
 - 8. The following is an example of an acceptable description given to the WMC:



Contacting Facility Specific Office of Protection Services Personnel

In the event WMC must notify OPS, a contact person must be identified at the facility's OPS office to provide the necessary coordination with the DC Fire Department when they arrive on the scene. The following information shall be provided to facility's OPS office:

• The descriptive information located in the "Notification of Work Management Center Prior to Confined Space Entry" section of this document.

Contacting the DC Fire Department Special Operations Battalion for Pre-Notification

If pre-notification is necessary, the WMC shall notify the DC Fire Department Special Operations Battalion Chiefs through either phone or email contacts that are kept on file in the OPS Offices. The Battalion Chiefs can be reached (b) (6)

The following information shall be provided to the DC Fire Department Special Operations Battalion:

- The descriptive information located in the "Notification of Work Management Center Prior to Confined Space Entry" section of this document.
- A copy of the Space Specific Form for the applicable space being entered.
- The name and phone number of the facility specific OPS office contact person established in the "Contacting Facility Specific Office of Protection Services Personnel" section of this document.

* Note: Entry into the permit space shall not occur until communication is established with OPSCC, the facility's OPS office, and the DC Fire Department Special Operations Battalion personnel. Leaving a voicemail or sending email does not alone constitute sufficient contact.

If Rescue Services Need to be Summoned

Prior to entry into the PRCS to begin work, a VoIP telephone shall be located in order to summon rescue services. In the event that a VoIP telephone cannot be located, or the VoIP phone is out of immediate reach, a direct phone number for OPSCC shall be obtained and utilized if services need to be summoned.

In the event of emergency, personnel in the vicinity of the confined space (preferably the confined space supervisor or attendant) should call 911 from the nearest VoIP phone or use the previously obtained direct OPSCC phone number to summon rescue services.

Warning!!!- It is imperative that these procedures be followed in order to properly notify OPS, allowing for the coordination with and direction of DC Fire Special Operations Battalion personnel once they arrive on the scene.

After the emergency call is placed, a member of the confined space team (attendant or supervisor) must proceed to meet rescue personnel at the location given in Item 6 in the "Notification of Work Management Center Prior to Confined Space Entry" section of this document. 4 Revision 2 (3-14-2011).

Coordination of SI Employees with DC Fire Department Personnel

In order to provide the best information to the DC Fire Department Special Operations Battalion, SI employees are directed to assist DC Fire Personnel with information on the condition of the victim as well as the location of any known hazards present in the space to be entered.

Contracting Officer's Technical Representative (COTR) Rescue Responsibility

All Office of Facilities Management and Reliability COTR's shall ensure, through contractual requirement, that contractors performing work in confined spaces have a confined space rescue plan meeting or surpassing the requirements set forth in this document in place prior to entry into any confined space.

A rescue plan shall be developed for every task (job) that requires entry into a confined space either permitted or non-permitted. The plan will be written / recorded before the task commences. Always consult the OFMR Safety Office when developing rescue plans. At the beginning of any work activity where confined space entry is required, rescue plans shall be identified and discussed with all employees involved in the task.

All members who perform the confined space entry shall be briefed on the rescue plan to include specific equipment required for the rescue.

Rescue Procedures - Confined Space Entry-Rescue (Off-Mall Facilities)

OFMR maintains operations at all SI facilities, even those that are far removed from the DC Mall area. Due to this situation, the procedures discussed in this plan must be met be all OFMR personnel and offices. The program requirements for operation and rescue must be coordinated prior to any permit required confined space entry work being performed. Due to the location of these facilities, OFMR may need to procure a rescue team to stand-by during the entry or consult

with their local emergency response to verify if adequate rescue services are available. If neither of these are available, the confined space entry must be contracted out to a company that has staff trained in entry and rescue. If assistance is needed, contact the OFMR Safety Office for guidance.

5. Training

OFMR shall provide a PRCSE training program for each authorized employee who may be required to enter a confined space to perform work. The initial Confined Space Entry Training will be provided by outside contractors, refresher training will be provided by OFMR Safety. Each trainee will attend a site-specific training conducted by OFMR Safety. The site-specific training program shall include a review of confined space definitions, SI procedures and requirements, and equipment training. Training materials must be reviewed to verify that each employee has been trained, as necessary, by an experienced person qualified in the following areas:

- The nature of hazards associated with working in a confined space
- OFMR must maintain a written certification record for employee training. The record must contain the following information:
 - 1) The name and signature of the employee trained
 - 2) The date(s) of the training
 - 3) The name and signature of the person who conducted the training

When any OFMR staff has reason to believe that any authorized employee who has already been trained does not have the understanding and skill required by 29 CFR 1910.146, the employee must be retrained by either the supervisor or the OFMR Safety Managers. Retraining is required every three (3) years with an annual refresher or sooner in the following circumstances:

- Changes in the workplace rendering previous training obsolete;
- Changes in the types of fall protection systems or equipment to be used render previous training obsolete;
- Inadequacies in an employee's knowledge or use of equipment indicate that the employee has not retained the necessary understanding or skill.

6. Enforcement

- Documentation of any violations shall be kept in the staff member's personnel file.
- Any employee not following the PRCSE program, or a portion of this instruction or the procedures defined herein shall be subject to disciplinary action.

7. Program Evaluation

The PRCSE program will be evaluated periodically to determine effectiveness. The following criteria will be used to evaluate performance:

- Incident reports, number of incidents.
- Management/staff compliance with program components.
- Periodic on-site audits.
- Staff feedback.
- The annual review of all cancelled permits (Permits are required to be retained for a minimum of 1 year)

APPENDIX A: Definitions

"Acceptable entry conditions" means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

"Attendant" means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

"Authorized entrant" means an employee who is authorized by the employer to enter a permit space.

"Blanking or blinding" means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

"Confined space" means a space that: Is large enough and so configured that an employee can bodily enter and perform assigned work; Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and Is not designed for continuous employee occupancy.

"Double block and bleed" means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

"Emergency" means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

"Engulfment" means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

"Entry" means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

"Entry permit (permit)" means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in paragraph (f) of this section.

"Entry supervisor" means the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section. NOTE: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

"Hazardous atmosphere" means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit;

(5) Any other atmospheric condition that is immediately dangerous to life or health.

"Hot work permit" means the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

"Immediately dangerous to life or health (IDLH)" means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

"Inerting" means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

"Isolation" means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

"Line breaking" means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

"Non-permit confined space" means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

"Oxygen deficient atmosphere" means an atmosphere containing less than 19.5 percent oxygen by

volume.

"Oxygen enriched atmosphere" means an atmosphere containing more than 23.5 percent oxygen by volume.

"Permit-required confined space (permit space)" means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

(4) Contains any other recognized serious safety or health hazard.

"Permit-required confined space program (permit space program)" means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

"Permit system" means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

"Prohibited condition" means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

"Rescue service" means the personnel designated to rescue employees from permit spaces.

"Retrieval system" means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

"Testing" means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

APPENDIX B PRCSE Signs





APPENDIX C: Permit-Required Confined Space Decision Flow Chart

APPENDIX D: SI CS Entry Permit

CUI	MPI	NED S	PACE	PERMIT	
Service Work Or	rder #:	2008	-XXXXXX	ST IN-HOUSE	CONTRACTOR
NAME OF BUILDING AND C	ONTACTIN	UMBER:			
Name of Building:					
Project Title:					
Description and Tax					1
Fermit Issued To:			Phone:		=
Requested by:	_		Phone:		
EXACT LOCATION OF WORK AREA [Specific Area N	íame & Room ≢ and/or Exterio	or Location):		
AREA COVERED.					
REASON FOR ENTRY:	_	CONTRACTOR AND/OR SI	WORK GROUP & TYPE OF GENERA	L WORK EME	RGENCY PHONE
Select Type of Work from D	rop Downs.	Select "blank" to write i	n additional comments. (Con	racting Company Name, Emplo	oyee's Names
		and Emerge	ency Phone Number)		
I verify the above location has bee	in examined, th	e precautions checked on the personnel protect	required precautions checklist have tive equipment will be used.	been taken to ensure safety. Proper p	rocedures and
	-				_
			NAME		
NAME/SIGNATURE (Con	fined Space Ent	try Supervisor) & Date	NAME/SI	SNATURE (Project Manager or COTR) (if	applicable) 8. Date
PERMIT START DATE:	July	18 2008			
PERMIT START TIME :	5	5:00 AM	CONDITIONS HAVE BEEN	MET, PERMIT SIGNED FOR APPROVA	L AND POSTED.
PERMIT EXPIRE DATE:	July	18 2008	SERVICES (SECURITY MA BUILDING MANAGER	VAGER AND SECURITY CONTROL RO OFMR SAFETY MGR. AND SAFETY CO	OM OPERATOR),
PERMIT EXPIRE TIME :	7	7:00 AM			
CONFINED SPACE PERMIT IS ONLY	GOOD FOR 8 H	OURS FROM ISSUE DATE AND	D TIME UNLESS AREA HAS BEEN TO	STED AGAIN, PERMIT MUST BE AUTH	ORIZED BY ZONE
	NOTIFICATION	MANAGER OR DESIGNA	TED INDIVIDUAL PRIOR TO WORK		WE TAKEN
BUILDING SECURITY CONTROL OPER I	NOTIFIED *	OEDC PROJECT 1	MANAGER / COTR NOTIFIED	HOT WORK ALLOWED	In TAKEN
BUILDING MANAGER NOTIFIED *		ZONE PROJECT L	IAISON NOTIFIED	HOT WORK PROHIBETED	
WINC (1560) NOTIFIED *		USRO / HVAC SH	OP NOTIFIED	LOCK OUT TAG OUT REQUI	RED
MUSEUM DIRECTOR NOTIFIED		SED BLDG SYSTE	EM ENG (BAS) NOTIFIED	FIRE SYSTEM PERMIT REQU	TRED
BUILDING SAFETY COORDINATOR NOT	TIPIED *	SED CTRL SAFET	Y/FIRE PUMP SHOP NOTIFIED	HAZARDOUS OPERATIONS	STOPPED
		NMZ CTRL SHOP	S NOTUFIED		
SI OFMR SAFETY NOTIFIED			REQUIRED CORIES		
SI OFMR SAFETY NOTIFIED					
SLOFMR SAFETY NOTIFIED	pproval for	confined space entry	with the understanding the	at all safety codes and regula	ations will be
SLOFMR SAFETY NOTIFIED	pproval for	confined space entry f	with the understanding the followed.	at all safety codes and regula	ations will be
The above requestor has a	pproval for	confined space entry f	with the understanding the followed.	it all safety codes and regula	ations will be
SLOFMR SAFETY NOTIFIED The above requestor has a Example: The facility experienced sump pump. Fire f	pproval for I flooding in t Permit is not r	confined space entry f Additio he chiller room due to over reeded at this time nor exp	with the understanding the followed. onal Comments flow to main sump. The enginee ected. For Additional Information	it all safety codes and regula ing branch is inspecting and maki Contact: David Jones xxx xxx-xxa	ations will be ng repairs to the IX
St OFMR SAFETY NOTIFIED The above requestor has a Example: The facility experienced sump pump. Fire f Confined Space Permits can on	pproval for I flooding in th Permit is not r	Confined space entry f Additio he chiller room due to over needed at this time nor exp red by the ZM or his/her	with the understanding the followed. onal Comments flow to main sump. The enginee ected. For Additional Information	it all safety codes and regula ing branch is inspecting and maki Contact: David Jones xxx xxx-xxa	ng repairs to the tx

Service Wor	k Order #:	200	8-xxxxxx		
NAME OF BUILDING AN	D CONTACT NUMBER:				- 0
Parent Building:			0		
Project Title:			0		
factor of the second	OXYGEN DEFICIENCY	COMBLISTIBLE GA	5	MECHANI	
ATMOSPHERIC HAZARDS:	TOXIC CONTAMINANTS		PHYSICAL	HAZARI CHEMICA	/BIOLOGICAL NOISE
AUTHORIZED ENTRANTS	DATE TRAINED				
	sou	Pump or Lines	Blinded	VENTIL	Mechanical
ATTENDANTS'		Disconnected	or Blocked	0	Natural Ventilation Only
	Misc	x:	1. 19 C	-	and a sheet
		_			
	Required Precautions Checklist -	Precautions have	been taken by the Sup	ervisor Check (X	YES NO Nearest phone and fire alarm box
Personal Protective		-	_		identified
Equipment requires				-	Gas Free Technician and found rafe
Communication Procedures	Entrants	Туря	a of Gas Monitor	Callbrated	to eater
Service	satety Watch:				Mandatory Pre-Entry Briefing Conducted by Supervisor
TERT	ACCEPTABLE ENTRY	1 200 370	ATH STN C	th 7th Stn	INITIAL OF TESTER
OXYGEN (02)	19.5 to 23.5 %		-ur su e		Traffic Contro
EXPLOSIVE GAS	< 10% LEL				YES NO
HYDROGEN SULFIDE (H2S)	< 10 PPM + 15 PPM				Barricades 🗌
CARBON MONOXIDE (CO)	< 35 PPM				Flags 🗌 🗍
SULFUR DIOXIDE (\$02)	< 2 PPM * 5 PPM				Signs:
AROMATIC HYDROCARBON	« 1 PPM * 5 PPM				
AIRBORNE COMBUSTIBLE DUST	Meets or Exceeds LFL				* Short term exposure. L
AMMONIA	* 35 PPM				Avg. for 8 hrs. (longe appropriate resolutions of
	TIME]	AINING		-	actuation reasonant to
Make note of any spe	cial training by providing type, t	rainer and date trai	ned:		1. 75
	SPECIAL REQUIREMEN	TS AND PERMITS			Check (X) YES 10
1	LockOut / TagOut Required - I	Proper procedures	will be used and note	d in the LOTO Log	
	Utility impairment Notification	n Form Required -I	Notification Form SI-O	FMR001 Attached	
	Hot Work Permit Fo	rm Required - Pern	nit Form \$1-OFMR003 .	Attached	
UREMENTS: WORK SUPERVISOR	AREA MONITORING & GAS FREE	TECHNICIAN / CO	NFINED SPACE SUPE	RVISOR'S FINAL INSP	ECTION (COMPLETED AFTER CONFINED SPAC
PERFORMED WORK IN A S	AFE MANNER	×	CONFINED SPAC	E PERMIT POSTED & T	URNED INTO API
AREA CLEANED & EQUIPM	ENT STOWED AWAY	E H	LOCKOUT / TAG	OUT REQUIRED AND U	QUIRED (ATTACHED). SED
NO PERSONNEL INJURIES	REPORTED	S FRE	INSPECTED ARE	RETY CONTROL ROOM A AFTER WORK (BACK	OPERATOR (WORK COMPLETED).
Comments:	Init	ial o		NT / DEPT HEAD (WOR	K COMPLETED)
Confined Space	Supervisor, Project Manag	er and/or COT	R Comments (Prin	or to turning in Pe	ermit to Building Management)
Formula The support of the sta	winom her hered sell monitor	at an examined. Th	inspection and re	mains were success	bil and completed on time. For Additional
APPENDIX E

PPE List for PRCSE Work The hazard type will determine the type of PPE necessary for entry

Entrants

Hard Hat/Bump Cap Safety Glasses / Goggles Full body harness Safety footwear Heavy work gloves Disposable gloves over the work gloves (Optional) Multi-gas detector Extraction lines (Attached to the full body harness) Disposable outerwear coveralls / shoe covers (Optional) Rubber over-shoes (Optional)

Other equipment:

Extraction equipment Tripod and winch Blower for space ventilation

APPENDIX F

Identified PRCS Areas List:

Please refer to the building specific confined space binder for a full list and assessments of all confined spaces and:

• Ensure a JHA and a rescue plan has been developed for each PRCS location identified

APPENDIX G

Permit Required Confined Space Reclassification

Facility/Confined Space Identification: Purpose of Entry:			Date:
HAZARD ELIMINATION			
Original Hazards in Confined Space	Method of	Elimination	Verified By:
Contification of Tononous Doc	Institution to No.	Downit Downing	d Caufined Susse
This is to certify that the Permit Required C reclassified as a Non-Permit Confined Space eliminated prior to entry. Additional expl is valid only while the confined space rema the space must be evacuated immediately a	onfined Space listed e for above date only anation is document ins free from hazards and re-evaluated.	on this document All hazards wit ed below as neces If hazards arise	has been temporarily thin this space have been sary. The reclassification e during the course of entry,
Special attention must be paid to hazards to applying chemicals, using solvents, etc.	hat arise as a produc Inder these circumsta	t of the work perfe	ormed, such as welding, ALL NOT BE USED and the
space must be entered under permit condit	ions.		
Additional Comments:			
Signature of Certifying Employee (confined s	space trained):	Date:	
Completed form will be provided to the Building	Manager upon comple	tion of work.	

APPENDIX I: References

1. U.S. Department of Labor, Occupational Safety & Health Administration, "Permit-Required Confined

Spaces," OSHA 3138-01R, 2004.

- 2. U.S. Department of Labor, Occupational Safety & Health Administration, "Confined Space Hazards,"
- 3. OSHA Permit-Required Confined Spaces Expert Advisor <u>www.dol.gov/elaws/confined.htm</u>
- 4. SI Safety Manual Chapter 15: <u>http://www.ofeo.si.edu/safety_health/docs/safety_manual/pdf%20PRISMout/ch_15_confine_d_space_entry.pdf</u>