Fort Peck Wellness Center

Assiniboine & Sioux Tribes of the Fort Peck Indian Reservation

HEALTH PROMOTION DISEASE PREVENTION
FORT PECK TRIBES

Office of Indian Energy Annual Program Review November 2022 Conference

Assiniboine & Sioux Tribes of the Fort Peck Indian Reservation

Fort Peck Health and Wellness Center Energy Project

Poplar, Montana

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Fort Peck Indian Reservation

- NE Montana
- 2.1 Million Acres
- Checkerboard Land Pattern

- Assiniboine & Sioux
- 11,000 members
- 6700 live on Reservation

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Fort Peck Health and Wellness Center

- Multi disciplinary Wellness/Activity Center
- Initiated in 2012 by Health Promotion Disease Prevention Program
- Established CAT (Construction Advisory Team) in October 2018, intratribal, multidisciplinary

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CAT Team

- Planning Office – 2 Representatives
- Tribes' Secretary Accountant
- Environmental Office – 1 Rep
- Legal Representation – 2 Reps
- Health Prevention Staff - 6 Reps
- Road Department – 1 Rep
- Minerals – 1 Rep

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CAT Deliverables

- Secured Civil Engineering services
- Advertised and selected Architectural Firm
- Reviewed funding options
- Established footprint of building
- Determined appropriate amenities
- Supported Green infrastructure options including DOE Grant
- Secures Tribal Executive Board support through information sharing including public outreach

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Past Related Activities

"Model Green Tribal Community" – FPT Strategic Plan

- Ground source heat pumps (GSHP) – Adult Correctional Facility & 8 tribal homes
- Rehab Cultural Center for increased insulation and lighting efficiency
- GSHP and EE lighting installed on Phase III Tribal HQs and new Community Center
- Sustainable Village

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Location

Poplar, Montana

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Project Objectives:

- **Objective 1: Install 72-78 kW of roof mounted solar Photo Voltaic System by the end of the 21st month**
- **Objective 2: Reduce utility bills by approximately 23% per year through installing 8 Building Energy Efficiency Measures (EEM's) by the end of the 21st month**

Baseline Assumptions, IECC 2012 compliant building:

- **Electric Usage: Approximately 900,000 kWh per year**
- **Natural Gas Usage: 65,262 therms per year (based on package VAV system)**
- **Total expected utility cost - $108,690.00 per year**

Energy Saving Expectations:

- **Solar PV Arrays – operating cost savings - $5,991.00**
- **8 accepted building envelope, lighting, & VAV HVAC EEM's - $25,570.00 per year**
- **Total expected utility cost savings - $31,561.00 per year = 29% annual reduction**

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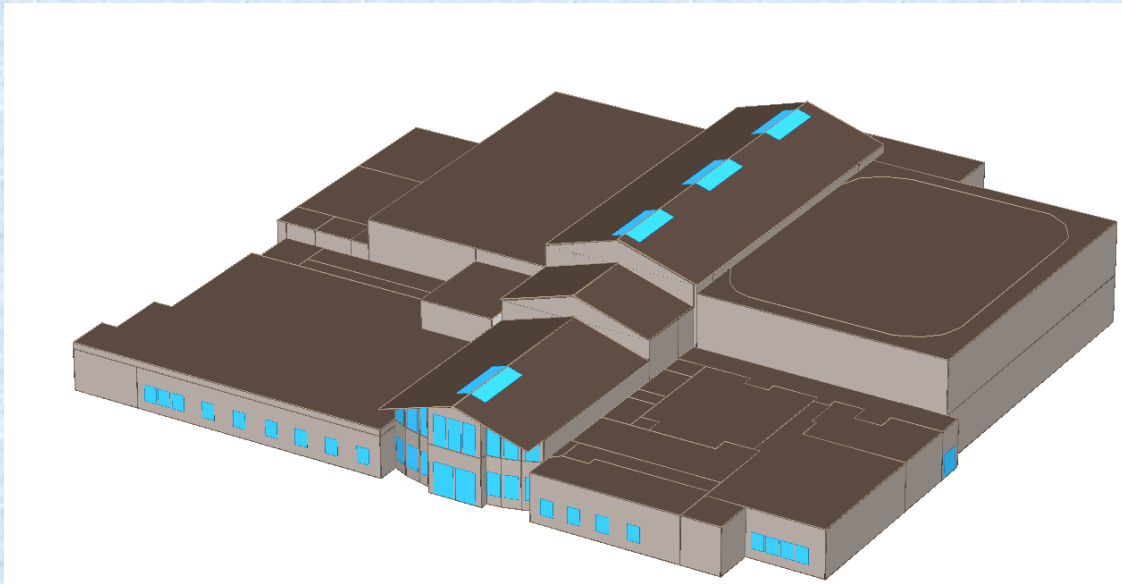

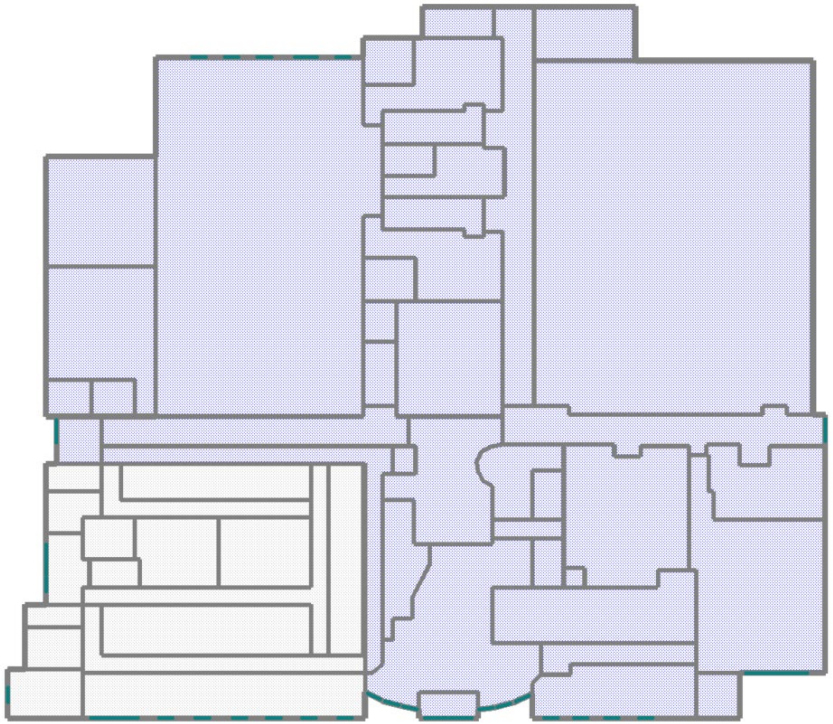

A detailed energy Simulation model was developed using eQuest (DOE 2.2) software.

Energy Savings:

- EEM's – 15 options considered and modeled
- EEM's – 8 options selected based on payback time frames

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EEM List and Energy Cost Savings Results

Item	Energy Efficiency Measure	Details	Energy Cost Savings per year	Cost Of Item (Baseline - EEM Cost)	Payback (Years)	EEM Accepted?	Reasoning for Acceptance or rejection
		Building Envelope and Lighting Components EEM Analysis					
E2	Improved Wall R value	IECC 2012 Code minimum vs. architectural wall of R-31.6	$ 1,009.00	$ 134,555.00	133	No	Poor payback
E4	Improved Roof R Value	IECC 2012 Code minimum vs. architectural roofof R-41.3	$ 592.00	$ 89,970.00	152	No	Poor payback
E8	Improved Windows	IECC 2012 Code minimum vs. triple glaze, Low E Argon Glass	$ 362.00	$ 10,823.00	30	Yes	Longer Payback, but helps meet comfort of occupants
E11	Improved Skylights	IECC 2012 baseline vs. High Performance U=0.16, SHG - 0.06	$ 475.00	$ 11,896.00	25	Yes	Fair Payback
L1	Provide High Efficiency Lighting (LED) and controls	IECC 2012 minimum vs. 0.6w/sf overall goal	$ 9,681.00	$ 53,466.00	6	Yes	Excellent payback
C1	Evaluate standard efficiency Geothermal Heat Pump vs standard VAV	Use standard efficiency comparison	$ 1,353.00	$ 100,000.00	74	No	Poor Payback
		VAV System EEM Analysis					
VM1	Utilize High Efficiency DX AHU	Versus Chilled Water AHU	$ 681.00	$ -	-	Yes	Instant Payback
VM2	Provide High Efficiency Chiller (if VAV)	Provide High Efficiency chiller vs. code minimum	$ 1,726.00	$ 54,000.00	31	No	Poor payback
VM3	Provide High Efficiency Boiler (if VAV)	Use Condensing boiler vs. code minimum boiler	$ 6,888.00	$ 114,408.00	17	Yes	Fair Payback, Helps meet 27% efficiency Goal
VM4	Provide Energy Recovery on AHU's	Provide heat wheel energy recovery between relief and fresh air	$ 3,155.00	$ 88,500.00	28	No	Will consume significant floor space in addition to moderate payback
S1	Provide Transpired Solar Collector	Minimum outside air through "solar wall" type transpired solar collector	$ 243.00	$ 10,200.00	42	No	Poor payback
		Pool Systems EEM Analysis					
VM5	Provide Pool HVAC Dehumidification Unit with heat recovery for pool heating	Use heat recovery on the Pool Dehumidification unit for pool heating. Cost includes HVAC unit upgrade and necessary piping and valves to pipe pool water to the heat recovery HX	$ 5,838.00	$ 10,000.00	2	Yes	Excellent payback
P1	Use High Efficiency Condensing Boiler for pool heating	Provide condensing boiler vs. 80% boiler for pool heating	$ 759.00	$ 16,310.00	21	Yes	Fair Payback, Helps meet 24% efficiency Goal
P2	Use Geothermal HP for pool heating vs. standard 80% boiler		$ (328.00)	N/A	N/A	No	No payback
P3	Utilize an Electric Pool cover	Use electrically operated pool cover (Pool Consultant)	$ 886.00	$ 24,270.00	27	Yes	Fair Payback, will also reduce dehumidification load

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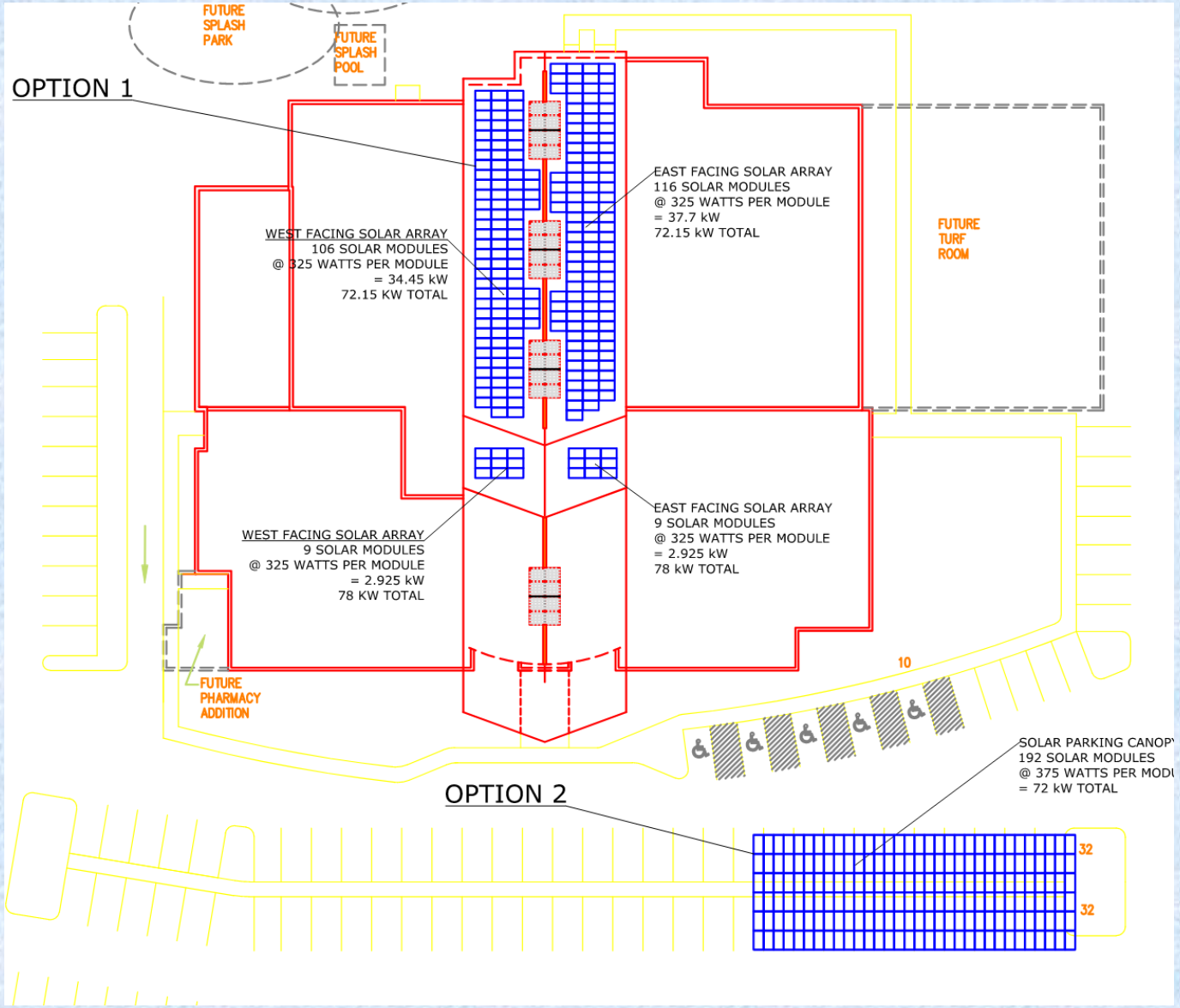

Energy Generation:

- Solar Photovoltaic Panels – Option 1 and 2
- Wind Power – Not considered due to recent system failures and significant maintenance issues

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CO2 Equivalents for EEM Energy Savings Including PV Panels	
268.3	Metric Tons of CO2 equivalent
56.9	Passenger vehicles drive for 1 year
655,546	Miles Driven by an Average Passenger Vehicle
30,170	Gallons of Gasoline Consumed
293,114	Pounds of Coal burned
621	Barrels of oil consumed

Overall installing the accepted envelope, lighting, PV and VAV HVAC measures would result in energy savings of about $31,561.00 per Year

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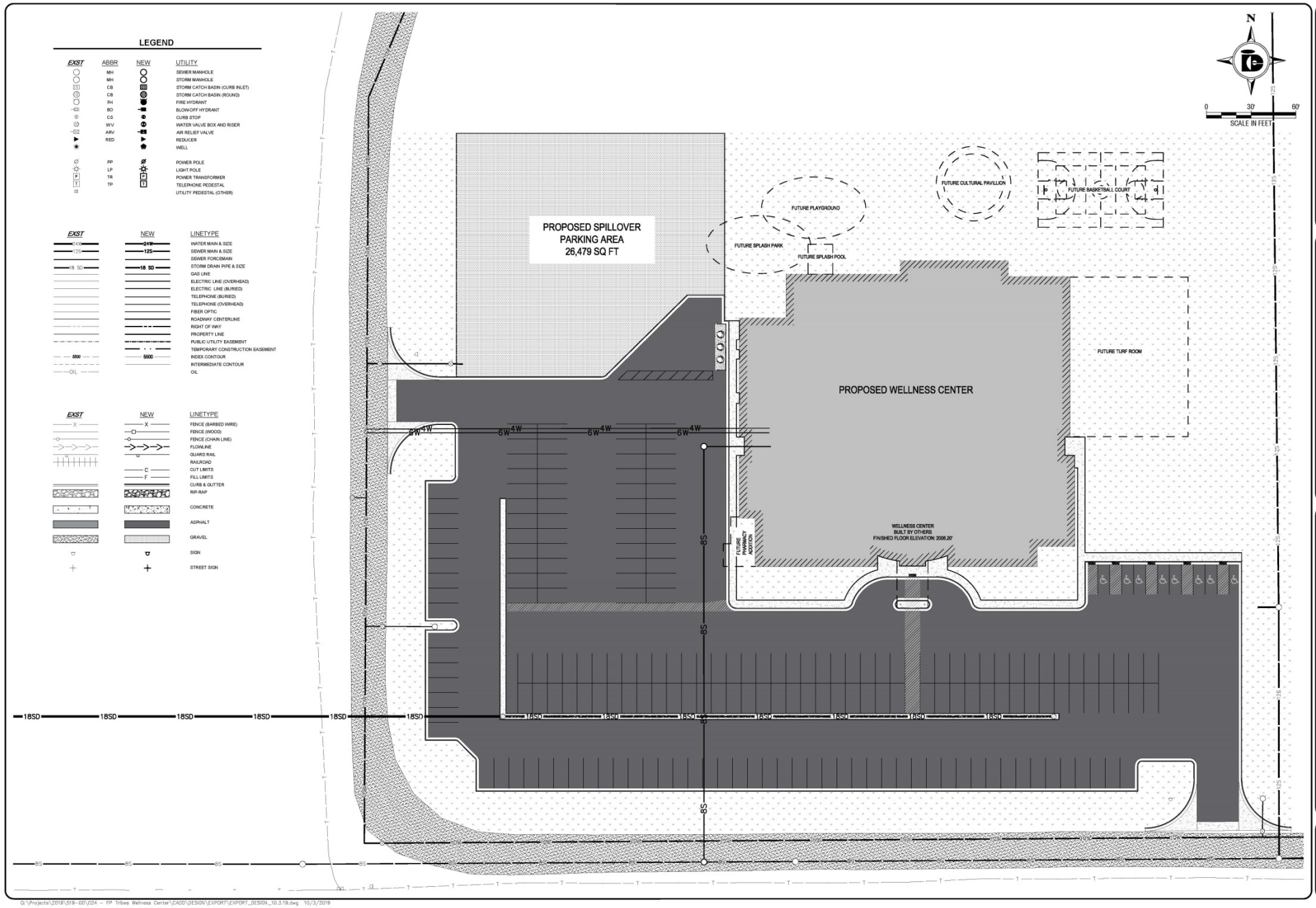

POPLAR WELLNESS CENTER
FORT PECK ASSINIBOINE AND SIOUX TRIBES
POPLAR, MT

PROPOSED SITE

Drawn By: TET
Checked By: RLK
Surveyed By: JOE
Designed By: TET/RLK
Project No: S19000024
Date: 10/2019

Rev No | Date | By | Description

Interstate Engineering, Inc.
P.O. Box 648
2177 Lincoln Ave. SE
Sidney, MT 59270-0648
Ph (406) 433-5617
Fax (406) 433-5618
www.interstateeng.com
Other offices in Minnesota, North Dakota and South Dakota

INTERSTATE ENGINEERING
Professionals you need, people you trust.

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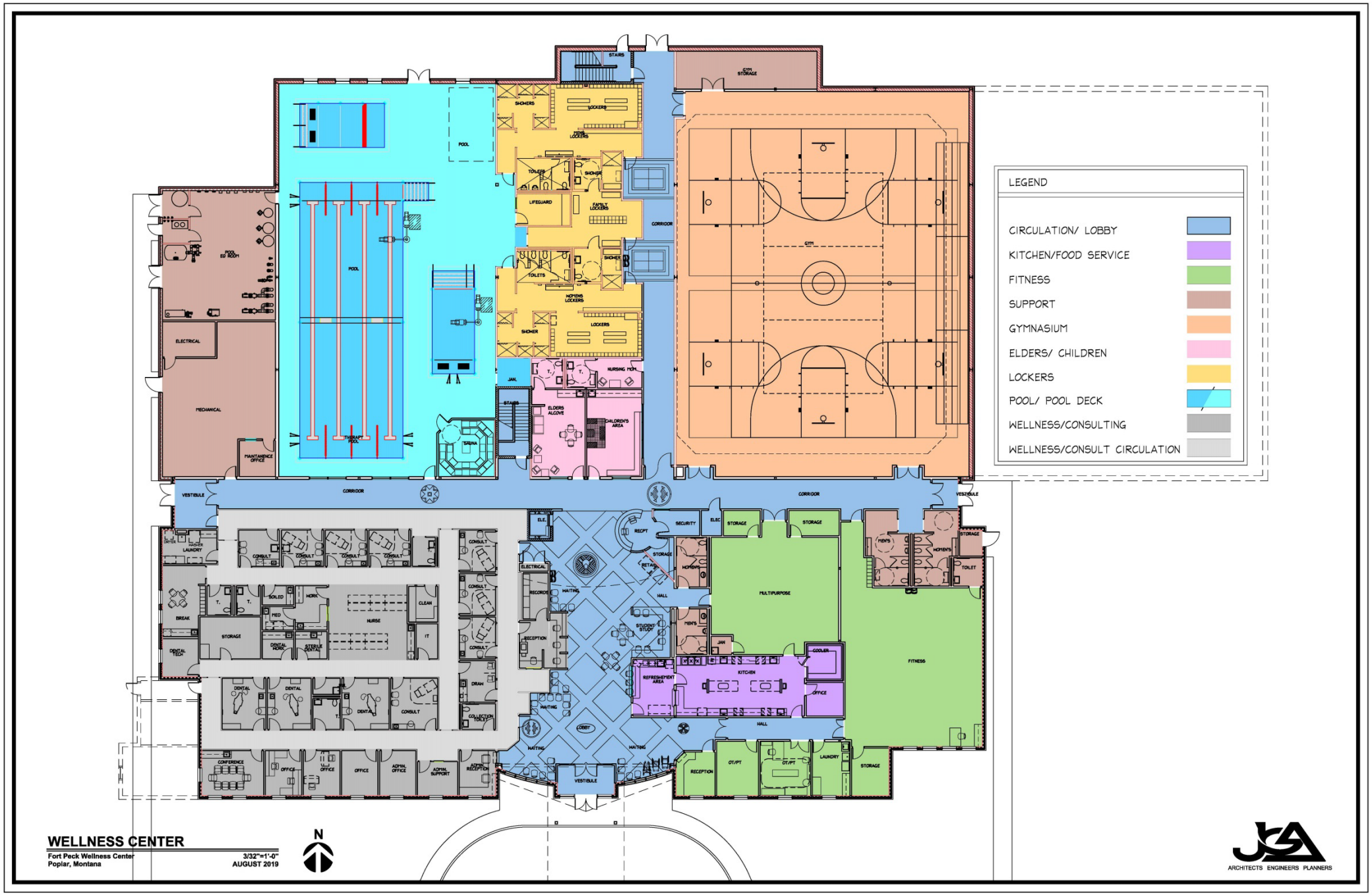

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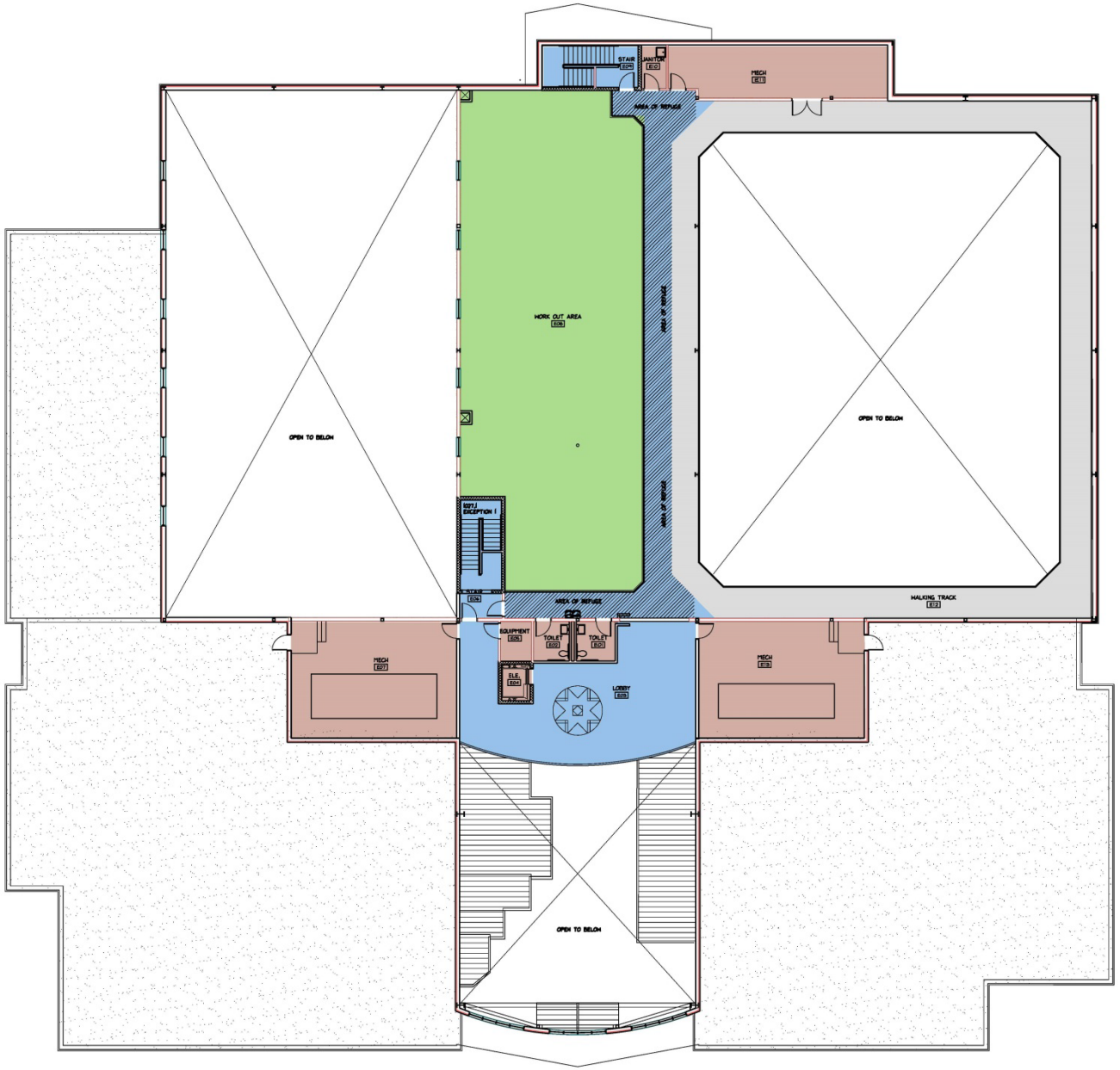

LEGEND

- CIRCULATION/ LOBBY
- WALKING TRACK
- FITNESS
- SUPPORT

WELLNESS CENTER

Fort Peck Wellness Center
Poplar, Montana

3/32"=1'-0"
AUGUST 2019

N

ARCHITECTS ENGINEERS PLANNERS

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JGA ARCHITECTS ENGINEERS PLANNERS

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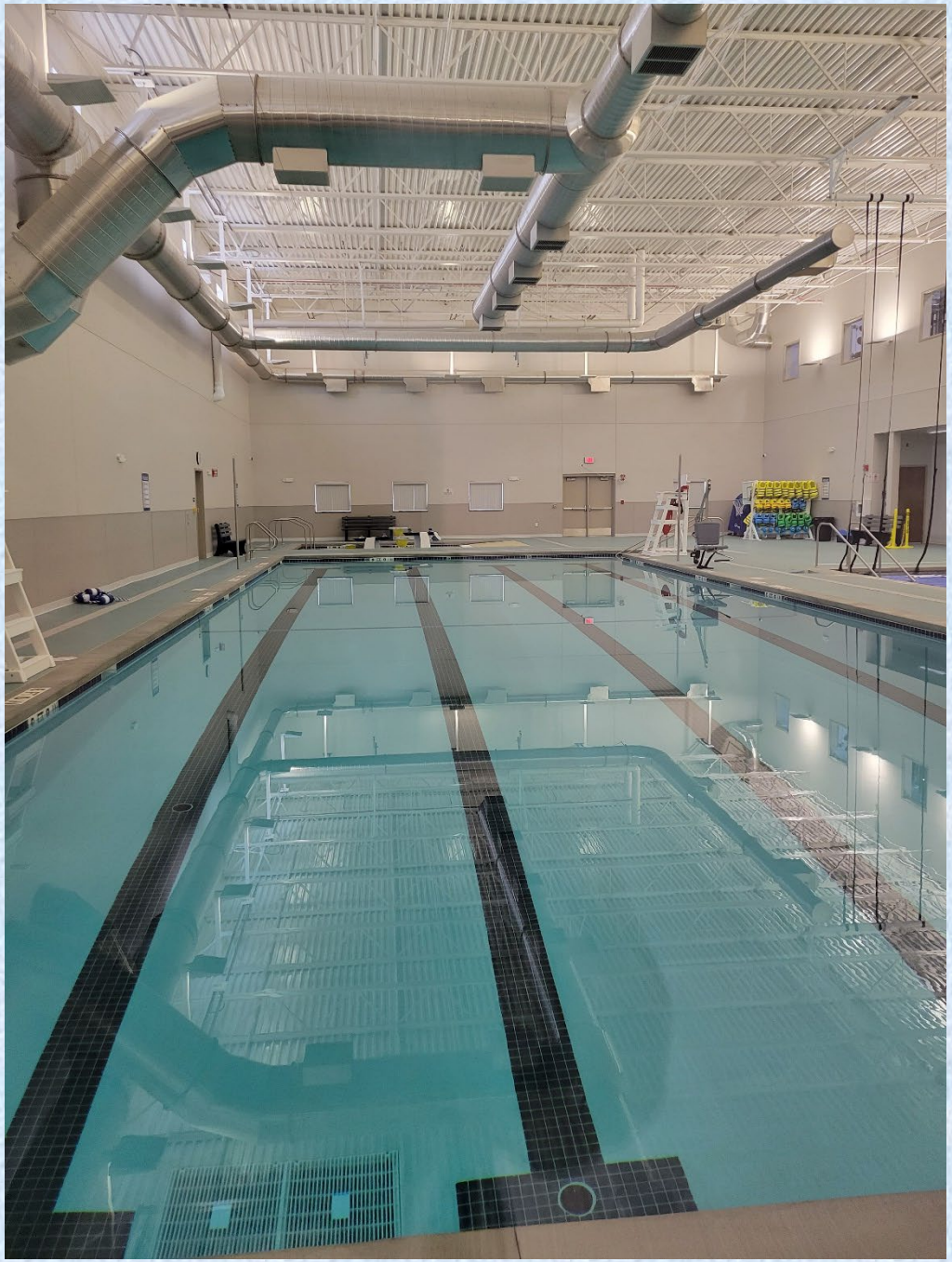

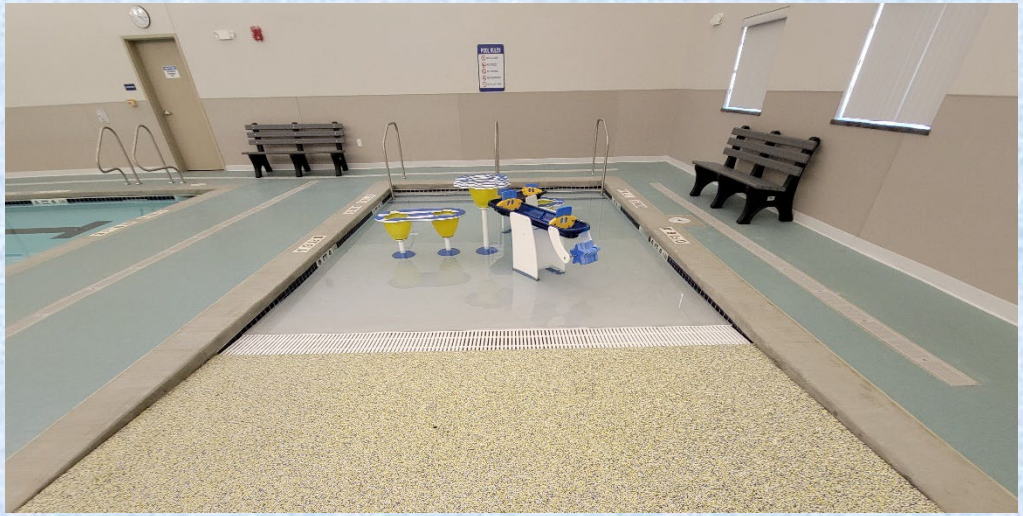

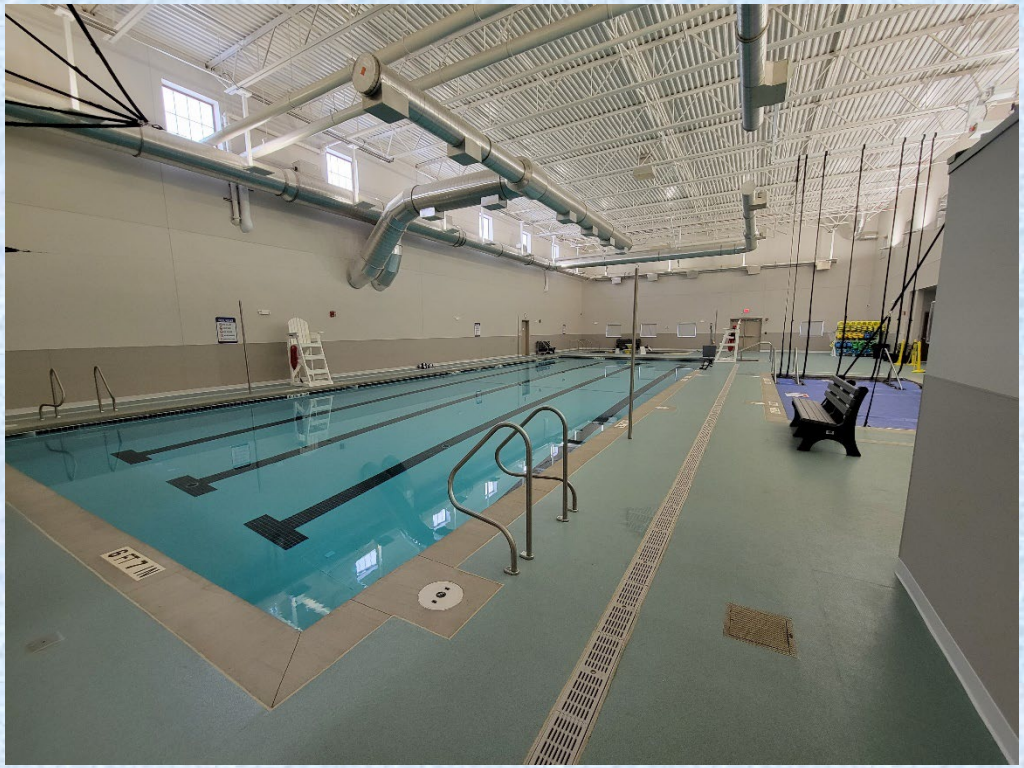

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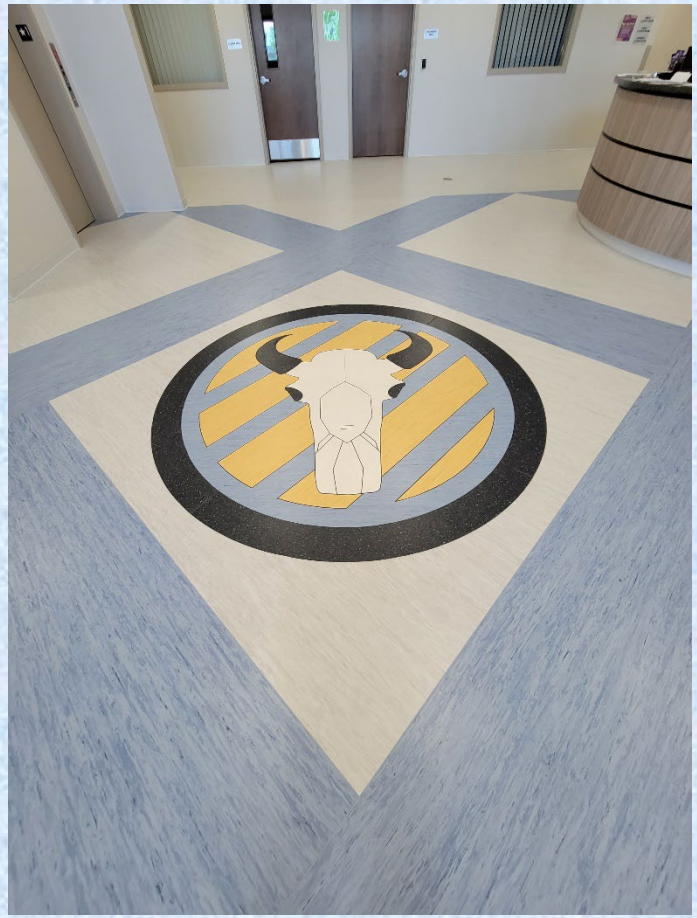

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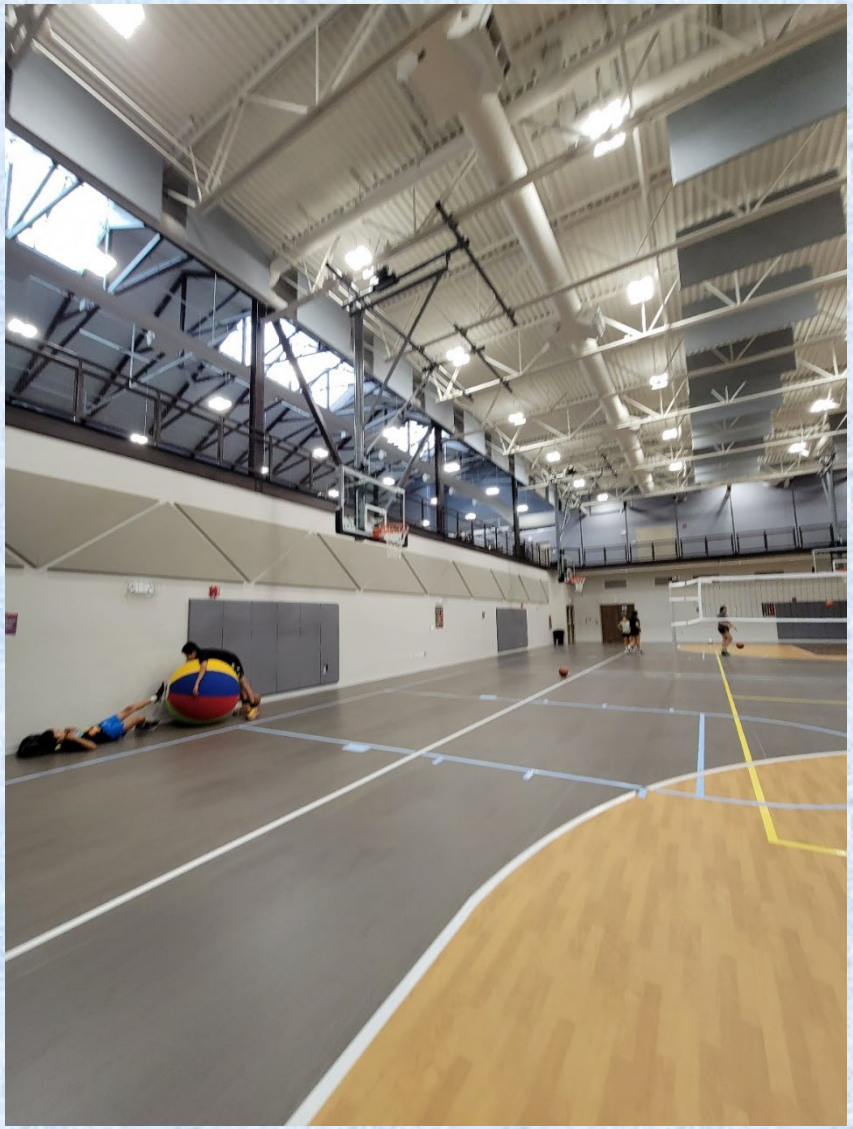

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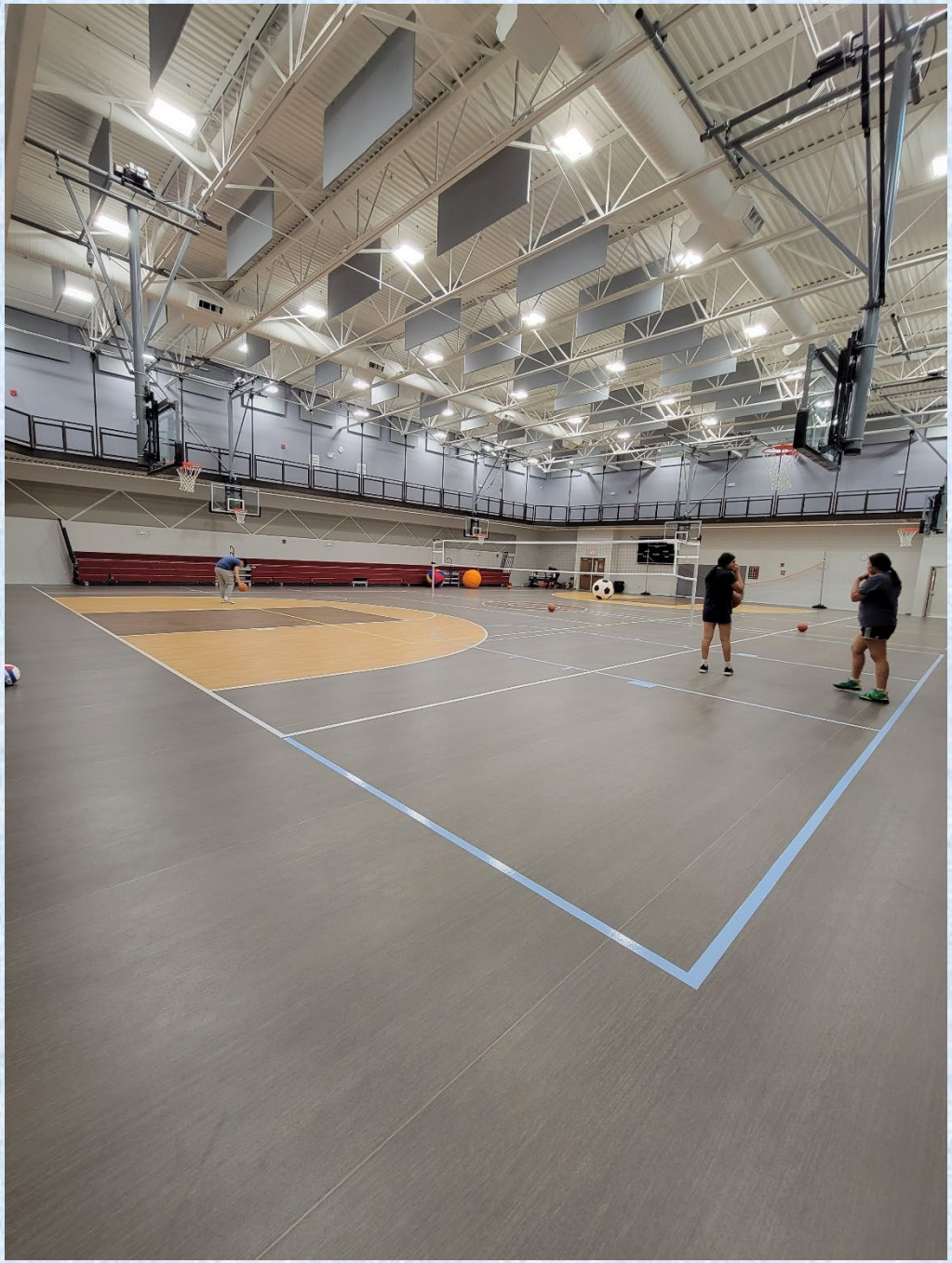

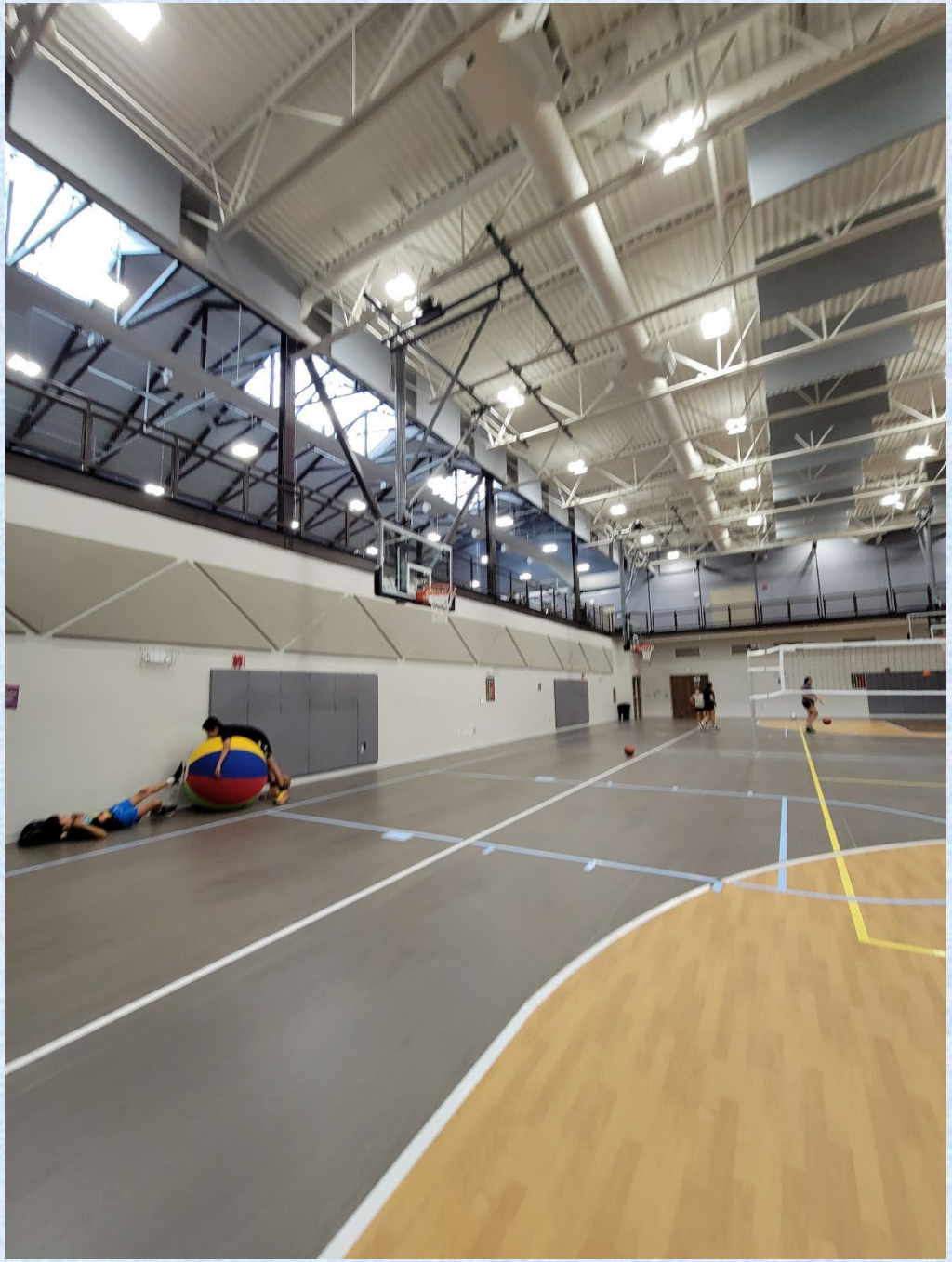

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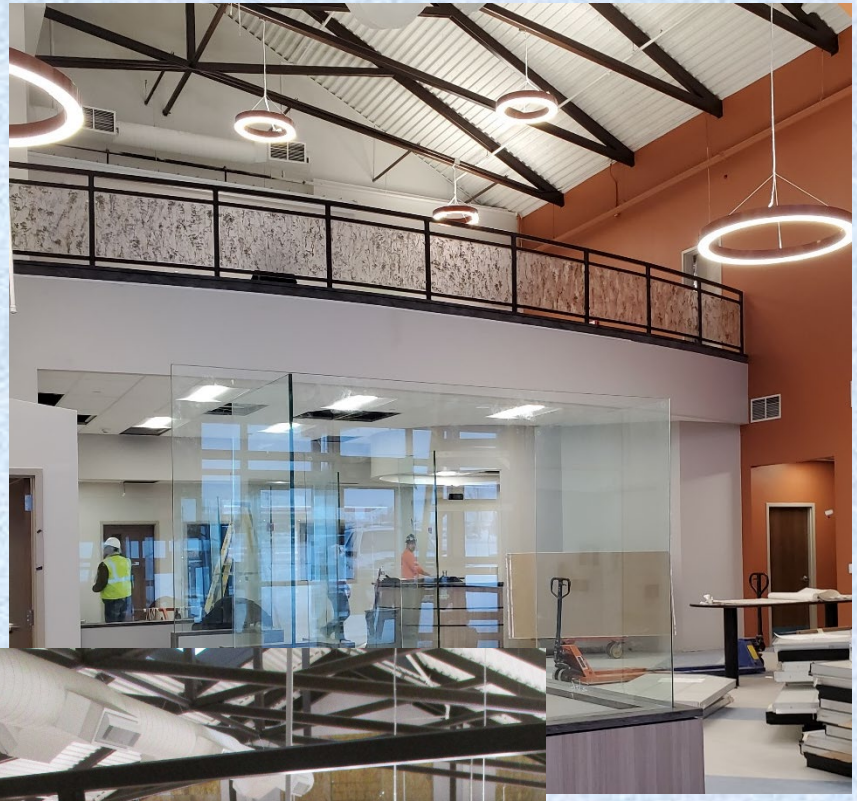

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The building has been in operation since March of 2022. As part of the funding scope, the project is required to conduct measurement and verification for the energy efficiency improvements included in the design. The following table summarizes the electricity, gas, and cost savings for each of the energy efficiency measures input into the project design. Overall, the installation of energy measures for the project is projected to reduce annual electricity usage by about **171,498 kWh per year** and gas usage by about **23,988 therms per year**. Total annual cost savings is expected to be about **$40,139 per year**, which is a **28%** reduction in operating cost compared to an IECC 2012 baseline design.

Including the solar PV system, total annual electricity savings would be **245,986 kWh per year** and cost savings of **$45,651 per year,** resulting in a **33%** reduction in operating cost compared to IECC 2012 baseline design.

Fort Peck Wellness Center Energy Performance

#	Run (Energy Use)	Site Energy				Source Energy		Utility Costs		
		Electric	Gas	Total	EUI	Total	EUI	Electric	Gas	Total Cost
		(kWh)	(Therm)	MMBtu	(kBtu/ft²)	MMBtu	(kBtu/ft²)	($)	($)	($)
B-0	IECC 2012 Baseline	743,012	67,083	9,243	177.8	15,004	288.5	$ 81,011	$ 60,374	$ 141,385
E1	R-31.6 Metal Exterior Wall	740,787	65,752	9,103	175.1	14,841	285.4	$ 80,734	$ 59,177	$ 139,911
E2	Design Window GT	739,984	65,519	9,077	174.6	14,807	284.8	$ 80,636	$ 58,967	$ 139,603
L1	Lighting Power Density = 0.68 W/sf	620,525	66,523	8,770	168.6	13,633	262.2	$ 68,069	$ 59,871	$ 127,940
M1	High Efficieny DX AHUs	562,980	63,272	8,248	158.6	12,675	243.8	$ 61,697	$ 56,945	$ 118,642
M2	High Efficiency, Condensing Boilers	572,883	51,394	7,094	136.4	11,534	221.8	$ 62,574	$ 46,255	$ 108,829
P1	High Efficiency Pool Heater	572,883	49,889	6,944	133.5	11,376	218.8	$ 62,574	$ 44,900	$ 107,474
P2	High Efficiency DHW Heater	572,883	48,880	6,843	131.6	11,270	216.7	$ 62,574	$ 43,992	$ 106,566
P3	Dehumidification Heat Recovery for Pool Heating	571,514	43,095	6,260	120.4	10,648	204.8	$ 62,461	$ 38,785	$ 101,246
R1	Solar PV System Generation	497,026	43,095	6,005	115.5	9,850	189.4	$ 56,949	$ 38,785	$ 95,734
Incremental Savings relative to Previous Measure (savings per ECM)										
E1	R-31.6 Metal Exterior Wall	2,225	1,331	141	2.7	164	3.1	$ 277	$ 1,197	$ 1,474
E2	Design Window GT	803	233	26	0.5	33	0.6	$ 98	$ 210	$ 308
L1	Lighting Power Density = 0.68 W/sf	119,459	(1,004)	307	5.9	1,174	22.6	$ 12,567	$ (904)	$ 11,663
M1	High Efficieny DX AHUs	57,545	3,251	521	10.0	958	18.4	$ 6,372	$ 2,926	$ 9,298
M2	High Efficiency, Condensing Boilers	(9,903)	11,878	1,154	22.2	1,141	21.9	$ (877)	$ 10,690	$ 9,813
P1	High Efficiency Pool Heater	-	1,505	151	2.9	158	3.0	$ -	$ 1,355	$ 1,355
P2	High Efficiency DHW Heater	-	1,009	101	1.9	106	2.0	$ -	$ 908	$ 908
P3	Dehumidification Heat Recovery for Pool Heating	1,369	5,785	583	11.2	622	12.0	$ 113	$ 5,207	$ 5,320
R1	Solar PV System Generation	74,488	-	254	4.9	798	15.3	$ 5,512	$ -	$ 5,512
Total Savings relative to Baseline (savings vs. ASHRAE 90.1-2012)										
	Total Savings w/o Solar PV	**171,498**	**23,988**	**2,984**	**57.4**	**4,356**	**83.8**	**$ 18,550**	**$ 21,589**	**$ 40,139**
	Total Percent Savings w/o Solar PV	**23%**	**36%**	**32%**	**32%**	**29%**	**29%**	**23%**	**36%**	**28%**
	Total Savings w/ Solar PV	**245,986**	**23,988**	**3,238**	**62.3**	**5,154**	**99.1**	**$ 24,062**	**$ 21,589**	**$ 45,651**
savings vs. ASHRAE 90.1-2012	**Total Percent Savings w/ Solar PV**	**33%**	**37%**	**36%**	**36%**	**35%**	**35%**	**30%**	**37%**	**33%**
Savings Comparison to Preliminary Analysis										
	Preliminary Savings w/o Solar PV	**177,377**	**18,951**	**2,500**	**48.1**	**3,890**	**74.8**			**$ 25,017**
	Actual Savings w/o Solar PV	**171,498**	**23,988**	**2,984**	**57.4**	**4,356**	**83.8**			**$ 40,139**
	Percent Change from Preliminary Results	**-3%**	**27%**	**19%**	**19%**	**12%**	**12%**			**60%**

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Overall, utility cost savings increased from ~$25,000 to $40,000 per year and overall energy savings increased by ~19%.

note this is savings, not usage

#	Energy Conservation Measure	Preliminary Savings			Actual Savings		
		Electricity (kWh/year)	Natural Gas (therms/year)	Cost ($/year)	Electricity (kWh/year)	Natural Gas (therms/year)	Cost ($/year)
E1	R-31.6 Metal Exterior Wall	2,171	1,140	$841	2,225	1,331	$1,474
E2	Design Window GT	690	523	$362	803	233	$308
L1	Lighting Power Density = 0.68 W/sf	169,356	-5,981	$9,681	119,459	-1,004	$11,663
M1	High Efficieny DX AHUs	8,725	0	$681	57,545	3,251	$9,298
M2	High Efficiency, Condensing Boilers	-4,125	12,219	$6,888	-9,903	11,878	$9,813
P1	High Efficiency Pool Heater	0	1,286	$759	0	1,505	$1,355
P2	High Efficiency DHW Heater		Not Modeled		0	1,009	$908
P3	Dehumidification Heat Recovery for Pool Heating	560	9,764	$5,805	1,369	5,785	$5,320
	Total Savings	**177,377**	**18,951**	**$25,017**	**171,498**	**23,988**	**$40,139**
	Percent Change from Preliminary Results				**-3.3%**	**26.6%**	**60.4%**

Step 1: match operation hours and setpoints to actual
Step 2: Compare to code in Energy Model - identifying savings

Utility rates increased significantly vs. modeled costs.

Clarification: both comparisons are based on comparison between our building and 2012 IECC comparison.

Major M&V Calibration changes:

Building Schedule (6 am-10pm, 7 days) operating schedule is less, resulting less savings (and lower energy costs)

Final Design Changes

Temperature Control Sequence

High Efficiency Water Heater

Power savings is lower. Due to actual pump use, differing schedule.

gas savings increased because: higher efficiency HW heater not originally modeled, High efficiency DX AHU's updated control scheme (better than original modeling) supply air temperature reset (less VAV reheat).

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missing 6 mos of utility information, so difficult to fully interpret data.

Given that the building was turned over for full operation in March of 2022, the calibration process is based on only six months utility data, from March 2022 to August 2022. The following graphs show the result of the calibration process for electricity usage. The bar chart represents the output from the energy model. The dotted black line represents electricity utility bill data and the solid black line represents total electricity usage for the building (utility bill data + solar PV generation).

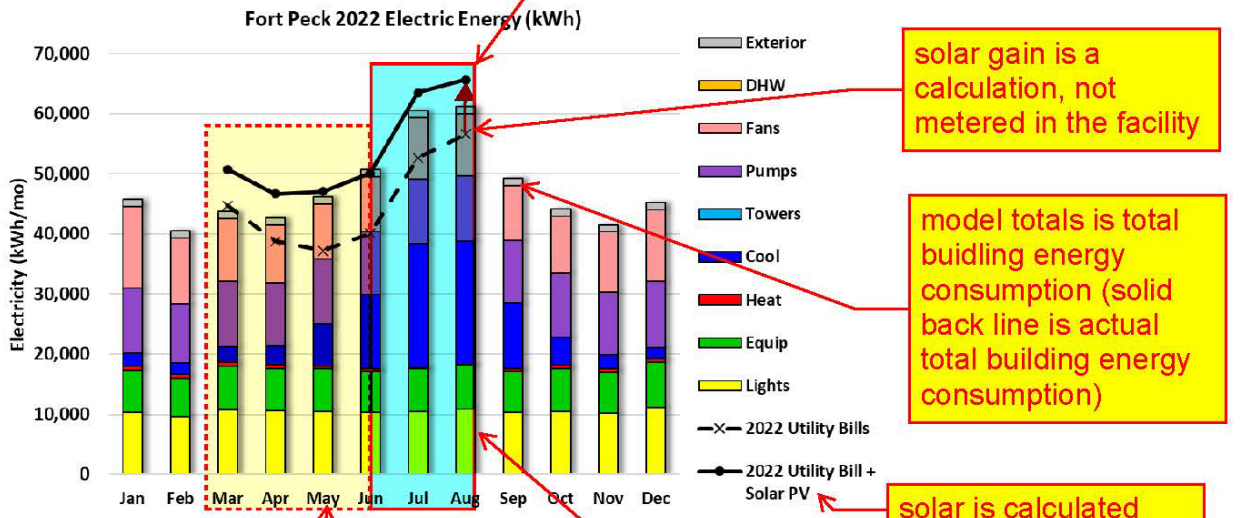

Figure 3: 2022 Electricity Calibration

solar gain is a calculation, not metered in the facility

model totals is total buidling energy consumption (solid back line is actual total building energy consumption)

solar is calculated

The natural gas calibration is shown in the following graph. As noticed below, the energy model is currently underpredicting natural gas energy usage during the winter months. Further investigation is required to understand the difference in actual natural gas usage and the output from the energy model.

mostly building move in and start up

time when building was in operation

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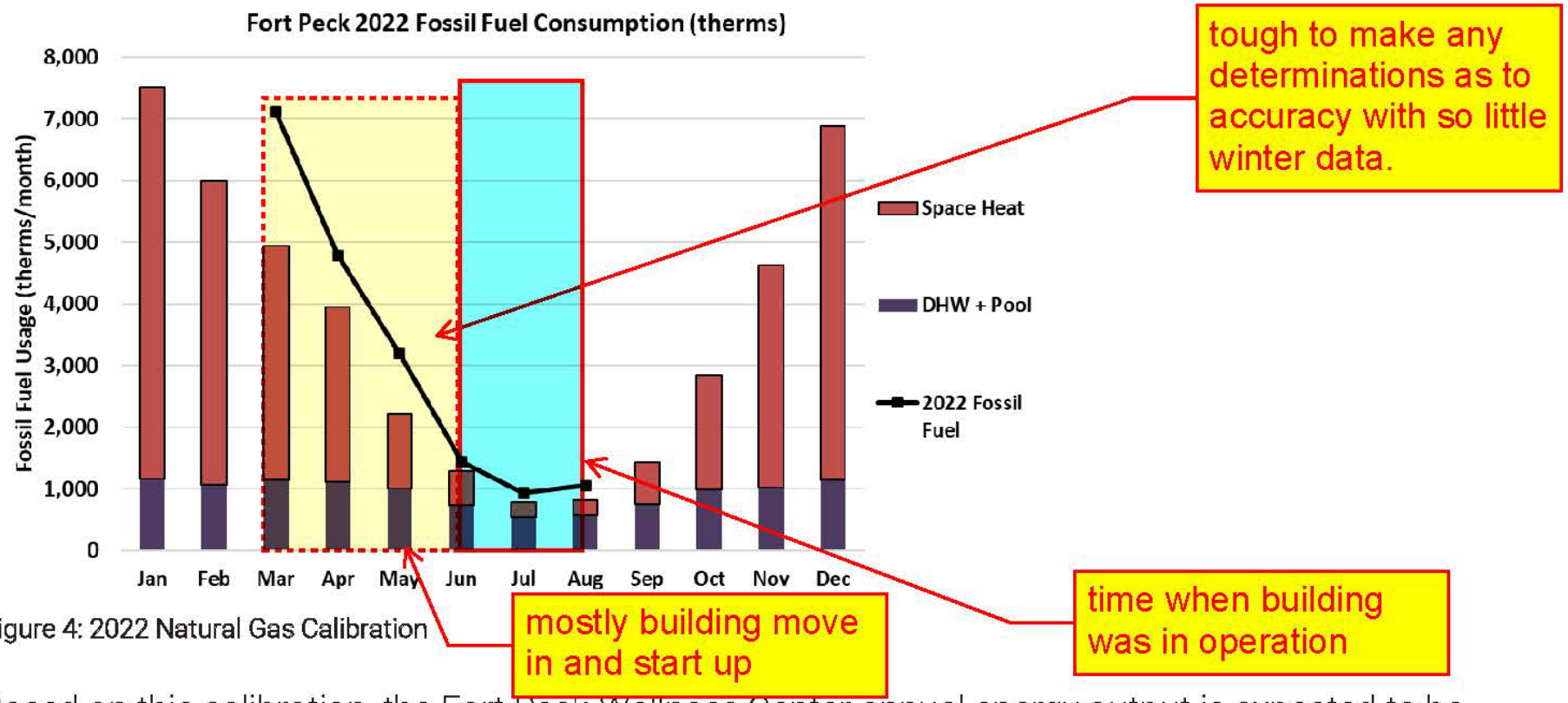

Figure 4: 2022 Natural Gas Calibration

Based on this calibration, the Fort Peck Wellness Center annual energy output is expected to be **571,514 kWh per year** and **43,095 therms per year**, resulting in an **EUI of 120.4 kbtu/SF/year.** The solar PV system would be expected to output **74,488 kWh per year**, offsetting **13%** of the total electricity consumption for the building.

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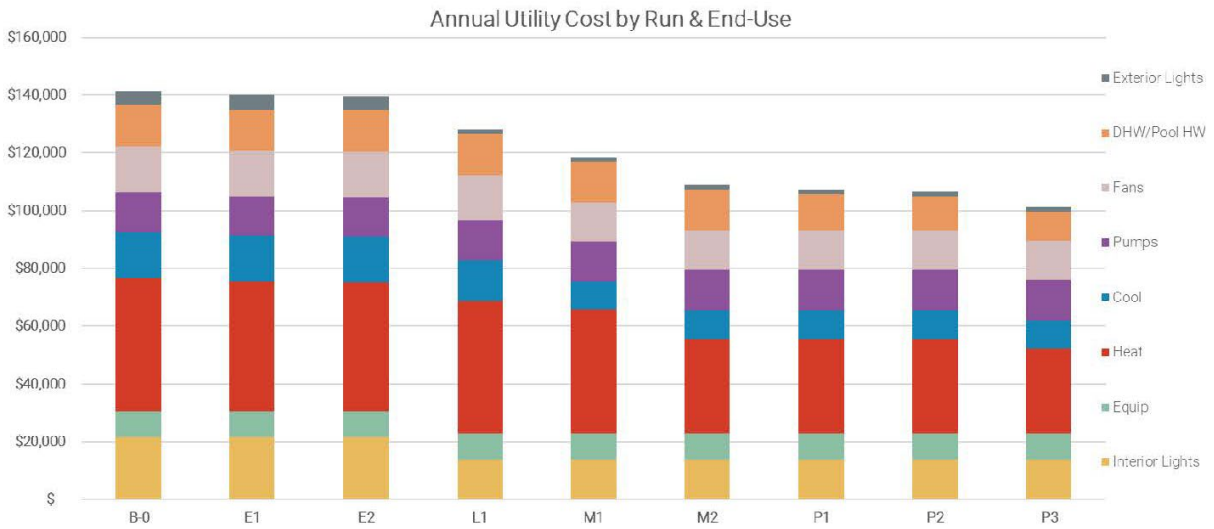
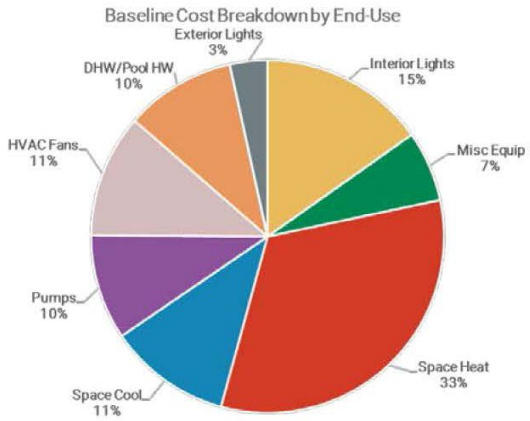
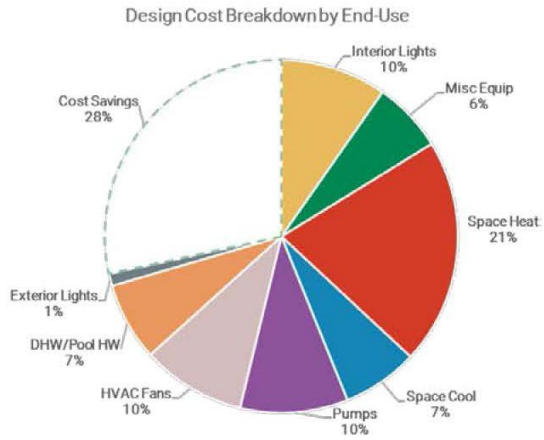
The following graph shows annual utility costs by end-use for each energy measure.



The following pie charts show the cost breakdown by end-use between the baseline (IECC 2012 model) and the calibrated design energy model.





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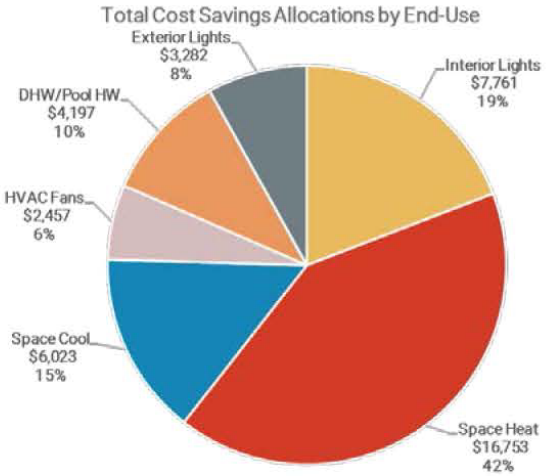
The following pie charts show the total cost savings broken down and allocated to each end-use. Based on this pie chart, 42% of the total cost savings are from reductions in space heating energy usage. This is to be expected as space heating comprises 33% of the total energy cost for the facility.



Overall, utility cost savings increased from **~$25,000 to $40,000** per year and overall energy savings increased by **~19%**.

#	Energy Conservation Measure	Preliminary Savings			Actual Savings		
		Electricity (kWh/year)	Natural Gas (therms/year)	Cost ($/year)	Electricity (kWh/year)	Natural Gas (therms/year)	Cost ($/year)
E1	R-31.6 Metal Exterior Wall	2,171	1,140	$841	2,225	1,331	$1,474
E2	Design Window GT	690	523	$362	803	233	$308
L1	Lighting Power Density = 0.68 W/sf	169,356	-5,981	$9,681	119,459	-1,004	$11,663
M1	High Efficieny DX AHUs	8,725	0	$681	57,545	3,251	$9,298
M2	High Efficiency, Condensing Boilers	-4,125	12,219	$6,888	-9,903	11,878	$9,813
P1	High Efficiency Pool Heater	0	1,286	$759	0	1,505	$1,355
P2	High Efficiency DHW Heater		Not Modeled		0	1,009	$908
P3	Dehumidification Heat Recovery for Pool Heating	560	9,764	$5,805	1,369	5,785	$5,320
	Total Savings	**177,377**	**18,951**	**$25,017**	**171,498**	**23,988**	**$40,139**

QUESTIONS & ANSWERS

Assiniboine & Sioux Tribes of the Fort Peck Indian Reservation

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Fort Peck Tribes Wellness Center Poplar, Montana March 28, 2019

ID	Task Name	Start	Finish
1	Fort Peck Tribes Wellness Center	Thu 12/20/18	Tue 5/14/19
2	Phase 1 Services - Preliminary Design and Programming	Thu 12/20/18	Tue 5/14/19
3	Kick-off meeting, communications plan/goal setting	Thu 12/20/18	Thu 12/20/18
4	Research and data gathering	Fri 12/21/18	Wed 1/2/19
5	Programming Session	Thu 1/3/19	Thu 1/3/19
6	Pre-design	Fri 1/4/19	Fri 1/11/19
7	Presentation of Program & Conceptual Design	Mon 1/14/19	Mon 1/14/19
8	Owner review and approval	Tue 1/15/19	Tue 1/29/19
9	Program refinement	Wed 1/30/19	Wed 2/6/19
10	Design Concept refinement	Thu 2/7/19	Thu 3/28/19
11	DOE Grant Assistance	Fri 3/29/19	Tue 4/30/19
12	Owner Review and Approval	Wed 5/1/19	Tue 5/14/19
13	Phase 2 Services - Schematic Design (SD) 10% Completion	Wed 5/1/19	Fri 6/25/21
14	Schematic design documents	Wed 5/15/19	Tue 6/25/19
15	SD - Cost model update	Wed 6/26/19	Mon 7/1/19
16	Facilities Roundtable	Tue 7/2/19	Tue 7/2/19
17	Owner Review and approval	Wed 7/3/19	Mon 7/8/19
18	Design Development (DD) integration 35% Completion	Wed 5/1/19	Mon 9/23/19
19	User review sessions	Tue 7/9/19	Wed 7/10/19
20	Design Development Drawings	Thu 7/11/19	Wed 9/11/19
21	DOE Grant Award Notification	Wed 5/1/19	Thu 8/1/19
22	EEM's and PV System input/coordination/Finalize Building Envelope detail	Mon 8/5/19	Fri 9/6/19
30	Engineering Coordination Meeting	Thu 9/12/19	Thu 9/12/19
31	DD Cost Model update	Fri 9/13/19	Wed 9/18/19
32	Owner Review and approval	Thu 9/19/19	Mon 9/23/19
33	Construction Document (CD) integration 60% Completion	Tue 9/24/19	Tue 1/21/20
34	Completion of CDs by design team	Tue 9/24/19	Tue 1/7/20
35	Finalize CD's & Building Envelope CD's - EEM's - E2, E4, E8 and E11	Tue 9/24/19	Tue 1/7/20
36	Finalize the CD's for EEM - L1 High Efficiency Lighting	Mon 9/30/19	Fri 10/11/19
37	Finalize the CD's For EEM - VM1 High Efficiency DX AHU	Mon 10/14/19	Fri 10/25/19
38	Finalize the CD's for EEM - VM3 High Efficiency Boiler	Mon 10/28/19	Fri 11/8/19
39	Finalize the CD'S for EEM - VM5 Dehumid Heat recovery for pool	Mon 11/11/19	Fri 11/22/19
40	Finalize the CD's for EEM - P1 High Efficiency Boiler for Pool	Mon 11/25/19	Fri 12/6/19
41	Finalize the CD'S for EEM - P3 Pool Covers	Mon 12/9/19	Fri 12/20/19
42	Finalize the CD's for EEM - PV1 Photovoltaic Array on Roof	Mon 12/23/19	Fri 1/3/20
43	CD's cost model refinement	Mon 1/6/20	Thu 1/9/20
44	Owner Review and approval 90% completion	Fri 1/10/20	Wed 1/15/20
45	CD pick-ups	Thu 1/16/20	Mon 1/20/20
46	Second review 100% Completion	Tue 1/21/20	Tue 1/21/20
47	Bidding/Plan Review and Permitting	Wed 1/22/20	Thu 2/20/20
48	Advertising for Bids	Wed 1/22/20	Thu 2/6/20
49	Submission to AHJ for Plan review	Wed 1/22/20	Tue 2/4/20
50	Pre-bid meeting - with Special emphasis on EEM's and PV Systems	Wed 2/5/20	Wed 2/5/20
51	Bid opening	Thu 2/6/20	Thu 2/6/20
52	Contracts/notice to proceed	Fri 2/7/20	Thu 2/20/20
53	Construction	Fri 2/21/20	Fri 6/25/21
54	Construction Administration (CA)	Fri 2/21/20	Mon 6/21/21
55	Building construction	Fri 2/21/20	Mon 6/21/21
56	Substantial Completion/Final acceptance	Tue 6/22/21	Fri 6/25/21
57	Warranty inspection - 11 months	Thu 5/26/22	Thu 5/26/22

Project: Fort Peck Tribes Wellness Center
Date: April 28, 2019

Task | Split | Progress | Milestone | Summary | Project Summary | External Tasks | External Milestone | Deadline

Fort Peck Wellness Center

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