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Feasibility Study of a Qualified Recycling Program at Fort Huachuca, Arizona

Dominique S. Gilbert, Stephen D. Cosper, Abigail M. Brake,
and Giselle Rodriguez

September 2018

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Abstract

This document details the processes and procedures that Fort Huachuca, Arizona, must follow to establish a qualified recycling program (QRP). QRP programs help installations meet Army goals to minimize waste disposal costs and increase waste diversion rates. This document will outline three optimizing recycling collection strategies: (1) collection from all buildings, (2) collection by building type, and (3) collection only from specific buildings. In an effort to help Fort Huachuca determine the feasibility of establishing a recycling and QRP program, these scenarios are formulated according to three main recycling and QRP program goals: income, diversion, and a combination of both income and diversion. Each scenario is presented with an economic analysis. Wherever feasible, the QRP is an effective mechanism, and it offers a cost-effective way to use funds from the sale of recyclables to support a recycling program and various morale, welfare, and recreation efforts.

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Abbreviations

Term	Meaning
AAFES	Army and Air Force Exchange Service
APF	appropriated funds
AR	Army Regulation
ASP	ammunition supply point
C&D	construction and demolition
CDC	Child Development Center
CFC	chlorofluorocarbon
CFR	Code of Federal Regulations
COF	Company Operational Facility
DD	Directives Division
DeCA	Defense Commissary Agency
DEMIL	demilitarization
DFAC	dining facilities
DFAS	Defense Finance and Accounting Services
DFMWR	Directorate of Family Morale, Welfare, and Recreation
DLA	Defense Logistics Agency
DOC	Distribution Operations Center
DoD	Department of Defense
DoDACC	DoD Activity Address Code
DoDI	Department of Defense Instruction
DOL	Directorate of Logistics
DPW	Directorate of Public Works
DTID	Disposal Turn-In Document
EO	Executive Order
EOCD	expanded shell ordinance casings deformer
EPG	Electronic Proving Ground
ERDC-CERL	Engineer Research and Development Center–Construction Engineering Research Laboratory
FMWR	Family and Morale, Welfare, and Recreation (Directorate)
FOG	fats, oils, grease
FY	fiscal year
GC	Garrison Commander
GIB	general information building
GOCO	government owned/contractor operated

Term	Meaning
GPW	general purpose warehouse
HQDA	Headquarters Department of the Army
IMARC	Installation Management Application Resource Center
IMCOM	Installation Management Command
ISWM	Installation Solid Waste Management
ISWMP	Installation Solid Waste Management Program
JITC	Joint Interoperability Test Command
LCC	life-cycle cost
LOA	Letter of Agreement
MARS	Military Affiliate Radio System
MDAS	material documented as safe
MFH	Military Family Housing
MOU	memorandum of understanding
MPPEH	Material Potentially Presenting an Explosive Hazard
NAF	nonappropriated funds
NETCOM	Network Enterprise Technology Command
NH	nonhazardous
OHC	Outpatient Health Center
OC	Oversight Committee
OCC	old corrugated cardboard
PAO	Public Affairs Office
PFF	physical fitness facility
POC	point of contact
PWS	performance work statement
PX	Post Exchange
QASAS	Quality Ammunition and Surveillance Assurance Specialist
QRP	qualified recycling program
QRP-OC	QRP Oversight Committee
RCI	Residential Communities Initiative
RCRA	Resource Conservation and Recovery Act
RMO	Resource Management Office
ROI	return on investment
SF	Standard Form
SJA	Staff Judge Advocate
SOP	standard operating procedures
SWAR	Solid Waste Annual Reporting

Term	Meaning
SWARWeb	web-based SWAR data management system
TDY	temporary duty
TEMF	tactical equipment maintenance facility
UEPH	Unaccompanied Enlisted Personnel Housing
USAICoE	U.S. Army Intelligence Center of Excellence
U.S.C.	United States Code
WC	waste characterization
WCF	working capital fund

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Preface

This study was conducted for U.S. Army Garrison Fort Huachuca under P2 Project Number 454201, “Evaluation of Waste Diversion Opportunities for Fort Huachuca, AZ.” The sponsor’s technical monitor was Mr. Jack Porter, Fort Huachuca.

The work was performed by the Environmental Processes Branch of the Installation Division (CEERD-CNE), U.S. Army Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL). At the time of publication, Mr. H. Garth Anderson was Chief, CEERD-CNE; Ms. Michelle Hanson was Chief, CEERD-CN; and Mr. Kurt Kinnevan, CEERD-CZT, was the Technical Director for Infrastructure for Combat Operations. The Deputy Director of ERDC-CERL was Dr. Kirankumar Topudurti, and the Director was Dr. Lance D. Hansen.

The Commander of ERDC was COL Ivan P. Beckman, and the Director was Dr. David W. Pittman.

Unit Conversion Factors

Multiply	By	To Obtain
gallons (U.S. liquid)	3.785412 E-03	cubic meters
pounds (mass)	0.45359237	kilograms
pounds (force) per square foot	47.88026	Pascals
square feet	0.09290304	square meters
tons (2,000 pounds, mass)	907.1847	kilograms
yards	0.9144	meters

1 Introduction to a Qualified Recycling Program

This document considers the feasibility of establishing a qualified recycling program (QRP) at Fort Huachuca, Arizona. Fort Huachuca is located in the southeastern corner of Arizona, at the northern end of the Huachuca Mountains, and near the town of Sierra Vista. It is the home of the U.S. Army Intelligence Center of Excellence (USAICoE) and the U.S. Army Network Enterprise Technology Command (NETCOM)/9th Army Signal Command. It is also the headquarters of Army Military Affiliate Radio System (MARS), the Joint Interoperability Test Command (JITC), and the Electronic Proving Ground (EPG).

Fort Huachuca is interested in implementing recycling and investigating the viability of starting a QRP. To that end, this document presents the results of a study of the feasibility and operating parameters for a QRP at Fort Huachuca.

1.1 Background

A QRP can be a cost-effective way for installations to support their recycling efforts. Several installations annually generate over \$1 million in proceeds by selling their recycling products. These installations are able to translate their successful QRP programs into financial benefits, in general for recycling programs and in particular for supporting an installation's Family and Morale, Welfare, and Recreation (FMWR) efforts. Installations like Fort Hood, Joint Base Lewis-McChord, and Fort Carson are some of the many examples of Army installations that maintain sustainable, profitable, and long-lasting QRPs.

The U.S. Armed Forces defines a QRP in the U.S. Code (U.S.C.) as "organized operations that require concerted efforts to divert or recover scrap or waste, as well as efforts to identify, segregate, and maintain the integrity of

the recyclable materials in order to maintain or enhance their marketability...”¹ This means that the QRP must follow a specified process and provide accountability for all materials in the program and for all funds received and/or expended for QRP operations. The QRP is the mechanism that allows the installation to receive funds from the sale of recyclables. The installation QRP must work with all host and tenant organizations on post, including those in leased space. Contracts covering government owned/contractor operated (GOCO) facilities should include opportunities for a contractor to participate in a QRP.

Under 10 U.S.C. 2577 and consistent with Department of Defense (DoD) financial management regulation 7000.14-R,² a QRP shall use sales proceeds from recyclables for only three purposes, listed below in priority order:

1. **Cost of recycling programs.** “...to cover the costs of operations, maintenance, and overhead for processing recyclable materials at the installation (including the cost of any equipment purchased for recycling purposes);” “...and if a balance remains, then:
2. **Installation pollution abatement.** “...not more than 50% of that balance may be used at the installation for projects for pollution abatement, energy conservation, and occupational safety and health activities. A project may not be carried out under the preceding sentence for an amount greater than 50% of the amount established by law as the maximum amount for a minor construction project...”
3. **FMWR accounts.** “...the remaining balance available to a military installation may be transferred to the non-appropriated morale and welfare account of the installation to be used for any morale or welfare activity.”

As stated, QRP proceeds may only be used for the purposes listed above. At the end of the fiscal year, any QRP account balance over \$2,000,000 will revert to the U.S. Treasury. In short, the revenues realized from the sale of recyclables must be adequate to support the recycling program, but

¹ 10 U.S.C. 2577, “Armed Forces - Disposal of Recyclable Materials” (Washington, DC: U.S. Armed Forces in U.S. Code, 2006 Edition, Suppl. 4, Title 10, 2006).

² DoD Financial Management Regulation (FMR) 700.14-R, “Reimbursable Operations Policy,” Volume 11a of Department of Defense Financial Management Regulation, (Washington, DC: Under Secretary of Defense – Comptroller, 2014).

excess funds can be used to support other initiatives like expanding recycling services and environmental efforts and, as stated above, up to 50% of sales proceeds can target FMWR efforts. QRP funds may NOT be used for appropriated fund labor or program start-up costs.

It is important to note that QRP funds are no-year funds, meaning that installations can maintain a running balance in the QRP account that extends across fiscal years, up to \$2,000,000.

While economic feasibility is the main goal for QRP operations, waste diversion is also an important objective; the recent Executive Order (EO) 13834³ (2018) orders federal agencies to minimize waste and to pursue cost-effective waste disposal measures as part of meeting federal sustainability goals. In some regions of the country where hauling rates and tipping fees are especially expensive, the avoidance costs alone (i.e., the costs that are avoided by recycling rather than landfilling) can make recycling economically feasible.

QRPs may be operated by the Directorate of Public Works (DPW) or non-appropriated funds (NAF) activities such as Directorate of Family Morale, Welfare, and Recreation (DFMWR). Although Army installations cannot establish more than one QRP on post, a regional QRP may provide services to more than one installation.⁴

However, even if it is determined that establishing a QRP is cost-prohibitive, Army Regulation (AR) 200-1⁵ requires recycling when mandated by state or local regulations pursuant to AR 420-49.⁶ Furthermore, CFR 246.200-1 requires that high-grade paper generated by offices with over

³ EO 13834, Efficient Federal Operations (Washington, DC: U.S. President Donald J. Trump, 17 May 2018).

⁴ 10 U.S.C. 2577, "Armed Forces - Disposal of Recyclable Materials."

⁵ AR 200-1, Environmental Protection and Enhancement (Washington, DC: U.S. Army Assistant Secretary of the Army, 21 February 1997 [updated 2007]).

⁶ AR 420-49, Utility Services (Washington, DC: U.S. Army, Heritage and Education Center, 19 September 2005 [rev.]).

100 workers shall be collected, separated at the source, and sold for recycling.⁷ For office facilities of less than 100 office workers, the recycling of high-grade paper should be implemented wherever feasible.

At Fort Huachuca, a QRP could be a potential mechanism to allow the installation to receive funds from the sale of its recyclables. Furthermore, a QRP at Fort Huachuca would offer cost savings by diverting waste materials from landfill to recycling, thus reducing hauling costs and tipping fees to landfill the materials.

1.2 Objective

The objective of this research was to explore the feasibility of establishing a QRP on Fort Huachuca and to review the different waste management efforts that would make a QRP profitable.

1.3 Approach

This work was performed in the following steps:

1. In July 2015, the CERL waste team performed a waste characterization. Waste characterization findings were detailed in a waste characterization study reported to Installation Management Command (IMCOM) in 2016.
2. Those waste characterization findings were used herein to determine the feasibility of a QRP at Fort Huachuca.
3. The QRP feasibility results were determined (Section 6.3), as were optimized waste collection strategies (Chapter 7) and a summary of cost and benefits per each of three scenarios (Chapter 8).

1.4 Scope

Although this work was undertaken to determine the feasibility of a QRP at Fort Huachuca, the methods to determine the cost/benefit and optimization of waste collection strategies may apply broadly at many DoD facilities throughout the continental United States.

⁷ 40 CFR 246.200-1, "High-Grade Paper Recovery, Requirements," in Title 40 (Protection of Environment), Chapter I (EPA), Subchapter I (Solid Wastes), Part 246 (Source Separation for Materials Recovery Guidelines), Subpart B (Requirements and Recommended Procedures. (Washington, DC: U.S. Environmental Protection Agency, 41 *Federal Register* 16952, 23 April 1976).

2 Regulatory and Policy Guidance

The requirements for QRPs within the DoD are based on statutes, regulations, EOs, Department of Defense Instruction (DoDI), and Army policies. The Resource Conservation and Recovery Act of 1976 (RCRA)⁸ and a number of EOs have also emphasized waste diversion and recycling. All the policy agendas behind these various documents are to focus federal efforts on recycling and waste prevention. The following sections detail the federal, DoD, and Army regulations that apply to QRP operations and management of related funds.

2.1 Federal law

2.1.1 10 U.S.C. § 2577⁹

- Subsection (a)(1) maintains that the Secretary of Defense will prescribe regulations for the sale of recyclable materials at military departments or defense agencies and for the operation of recycling programs at military installations.
- Subsection (b)(1) outlines how a QRP is to use sales proceeds from recyclables, as described in section 1 above.

2.2 Code of Federal Regulations (CFR)

2.2.1 32 CFR 172¹⁰

- Subsection (3)(b) explains that amounts collected by the DoD for the sale of excess and surplus property shall be deposited promptly to the U.S. Treasury accounts.
- Subsections (c)(1), (c)(2), and (c)(3) also discuss QRP use of sales proceeds from recyclables, as mentioned above.

⁸ Resource and Recovery Act of 1976, Public Law (P.L.) 94-580 (Washington, DC: 94th United States Congress and President Gerald Ford, 1976).

⁹ 10 U.S.C. §2577, “Armed Forces - Disposal of Recyclable Materials.”

¹⁰ 32 CFR 172. Title 32 (National Defense) Subtitle A (Department of Defense) Part 172, Disposition of Proceeds from DoD Sales of Surplus Property, Published at 54 *Federal Register* 35483. (Washington, DC: Department of Defense, 2011).

2.2.2 40 CFR 246.200¹¹

- Section 246.200-1 (“Requirements”) states that high-grade paper recovery generated by office facilities with over 100 office workers shall be separated at the source of generation, separately collected, and sold for the purpose of recycling.
- Section 246.200-2 (“Recommended procedures: High-grade paper recovery”) states that high-grade paper recovery generated by office facilities of less than 100 office workers should be implemented where markets make it feasible.
- Section 246.202-1 (“Requirement”) says that corrugated container recovery from commercial establishments generating 10 or more tons of corrugated container waste per month shall separately collect and sell this material for the purpose of recycling.
- Section 246.202-2 (“Recommended procedures: corrugated container recovery”) says that corrugated container recovery from commercial facilities generating less than 10 tons per month should be implemented where markets make it feasible.

2.2.3 40 CFR 246.100¹²

- CFR 246.100 (f) explains that federal agencies that decide not to source separate shall make available the analysis and rationale used in making that determination. Federal agencies can decide not to source separate if the inability to sell is due to lack of market, and costs are so high as to render source separation for materials recovery economically impracticable.

¹¹ 40 CFR 246.200, “High-Grade Paper Recovery,” in Title 40 (Protection of Environment), Chapter I (EPA), Subchapter I (Solid Wastes), Part 246 (Source Separation for Materials Recovery Guidelines), Subpart B (Requirements and Recommended Procedures). (Washington, DC: U.S. Environmental Protection Agency, 41 *Federal Register* 16952, 23 April 1976).

¹² 40 CFR 246.100, Protection of Environment (Title 40), Environmental Protection Agency (Chapter 1) Source Separation for Materials Recovery Guidelines (Part 246), General Provisions (Subpart A), Scope (§ 246.100). (41 *Federal Register* 16952, 23 April 1976).

2.3 Executive Order

Executive Order (EO) 13834, Efficient Federal Operations, orders federal agencies to adopt methods for increased efficiency, including minimizing waste and pursuing cost-effective waste disposal measures as part of meeting federal sustainability goals.

2.4 Department of Defense Instruction

DoDI 4715.23, Integrated Recycling and Solid Waste Management,¹³ establishes responsibilities and outlines procedures for integrated solid waste management (ISWM) through waste prevention and recycling. Section 4 of this instruction outlines the operations, procedural requirements, and financial management necessary to run a QRP. It explains the type of commodity market and economic feasibility analysis that should be pursued as well as the type of training necessary to manage a QRP. Finally, it lists items that are ineligible for a QRP.

2.5 Army Regulation

2.5.1 AR 420-1 (2012) – Army Facilities Management¹⁴

- Chapter 23-4, “Responsibilities.” Ensures that installations collect and report utility services operating data, to include electrical, heating, natural gas, potable water, wastewater, solid waste and recycling, in the prescribed reporting systems.
- 23–11 – Solid waste reduction, resource recovery, re-use and recycling, and composting practices. Discusses ways to reduce, recover, reuse and recycle. However, subsection (f) makes direct reference to QRPs and states that Installation Management Command (IMCOM) will ensure the implementation of a QRP, where life-cycle cost (LCC) effective. It also says that installations with several recycling programs will incorporate them into a single garrison QRP. Exceptions are those organizations with activities operating under special funding categories, such as commissaries, post exchanges, and working capital or industrial funds,

¹³ DoDI 4715.23, Integrated Recycling and Solid Waste Management (Washington, DC: Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics, 24 October 2016).

¹⁴ AR 420-1, Army Facilities Management, Facilities Engineering (Washington, DC: Headquarters Department of the Army, 12 February 2008, Rapid Action Revision 2012).

as these may have separate recycling programs, or they may donate their recyclables to the installation QRP.

- 23-15 – Solid waste reporting. Addresses the policies with respect to the reporting of solid waste disposal.

3 Establishing a QRP

There are five main steps to setting up a QRP, as listed below:

1. Establish feasibility of a QRP.
2. Prepare a memo stating the Garrison Commander (GC) wants a QRP.
3. Establish a suspense account for depositing QRP funds.
4. Determine whether to conduct direct sales or partner with Defense Logistics Agency (DLA) Disposition Services to sell materials.
5. Prepare documents explaining program operations.

3.1 Step 1: Establish feasibility of a QRP

This step determines whether there is enough recycling potential to warrant a QRP. This step requires a baseline knowledge of the component parts of the waste stream. This knowledge is best achieved with a waste characterization (WC) study that will detail types and quantities of recyclables generated at each individual building as well as installation-wide. Based on the WC results, a determination then can be made as to which tenant organizations generate the most recyclables. Note that researchers at the Engineer Research and Development Center–Construction Engineering Research Laboratory (ERDC-CERL) performed a WC study with the DPW at Fort Huachuca in 2015 and reported the results to the U.S. Army IMCOM in June 2016 (see Chapter 5 for a summary).

After a WC study, a market analysis should be conducted to determine whether it is cost effective for the installation to recycle and to establish a QRP. The market analysis should include an estimate of the revenues for each type of recyclable as well as all processing costs. For this effort, it is important to determine cost-benefits for the different outsourcing alternatives. Specifically, the market analysis should identify potential customers for each recyclable material, determine quality and quantity specifications for each recyclable, as well as look into potential transportation agreements, prices that buyers will pay, and the willingness of buyers to sign at guaranteed minimum prices. Chapter 8 of this report (p 44) explores different cost-benefit scenarios for establishing a QRP at Fort Huachuca.

3.2 Step 2: Prepare a memo that states the GC wants to have a QRP.

The GC must endorse a written recycling policy/regulation that includes all aspects of the recycling program.

3.3 Step 3: Establish a suspense account for depositing QRP funds

Establish a 3875 suspense account for depositing proceeds of sales from recyclable materials. This is done through the Resource Management Office (RMO). Next, the local DLA must be notified by memorandum that a QRP and an F3875 suspense account have been established. The memorandum must mention how the QRP and the DLA will work together to properly handle materials. Memorandum topics should include procedures for notifying and redirecting materials that accidentally end up in the QRP waste stream, such as usable or reusable items, items purchased with appropriated funds (APF), or Munitions List items turned in to the QRP by mistake. Similarly, authorized QRP items (see Chapter 4) such as aluminum cans or fired brass—that should have been processed and sold by the QRP—could have been sent inadvertently to the DLA. In this case, the DLA chief should inform the QRP that some QRP-eligible items were sent to the DLA, so the revenue from their sale can be properly credited to the QRP suspense account.

3.4 Step 4: Determine whether to conduct direct sales or partner with DLA to sell materials

The GC decides whether to conduct direct sales or partner with DLA to sell materials. (DoDI 4715.23 gives each military service the authority to grant direct sales authority to installation commanders.)

If the GC decides in favor of direct sales, then the GC must sign a letter of authorization and send it to Army IMCOM.

If the GC decides to go through the DLA, then the GC must acquire a letter of authorization establishing the agreement that QRP sales are to go through DLA. If deciding to go through DLA, then Release/Receipt Document, Directives Division (DD) Form 1348-1A, Disposal Turn-In Document (DTID) must be used.

3.5 Step 5: Prepare documents explaining program operations and designate needed personnel

After steps #1–4 have been completed, certain procedures must be performed and certain documents prepared. The following points outline protocols for how the program will run.

- The GC has to sign off on the choice of **QRP Manager**. The QRP Manager is usually either a person in the DPW and/or someone under the Environmental Division.
- The GC must establish a **QRP Oversight Committee (QRP-OC)** to establish procedures for the distribution of QRP sales proceeds after program operational costs have been covered and in accordance with 10 U.S.C. 2577.
- A **QRP Business Plan** must be prepared. It will include the feasibility study and waste stream analysis. The plan will identify the available resources and potential markets along with facility, equipment, and vehicle requirements. It should include the standard operating procedures (SOP), support the Installation Solid Waste Management Program (ISWMP), detail the QRP management goals, and disclose whether the installation will conduct direct sales or work with the DLA. If it is decided the QRP will conduct direct sales, then a standalone SOP specifically for QRP operations should be developed.

To ensure that QRP processes operate as intended and resources are safeguarded from fraud, waste, and misuse, the person responsible for selling the recyclable materials should not be the same person who is responsible for receiving, recording, and depositing the funds received from sales. However, if local circumstances prevent such separation from being established within the QRP, then management must establish and use appropriate oversight mechanisms from elsewhere on the installation to ensure that individuals do not misuse or abuse their assigned authority.

Step 5 also includes detailed financial management, records management, and reporting efforts. Financial management efforts are explained in the sections that follow.

3.6 Financial management

The following points comprise QRP financial management requirements:

- Make sure that QRP transactions shall be on a non-cash basis.
- Establish QRP direct sales abilities.
- Determine the QRP operating budget.
- Establish procedures for depositing proceeds into the F3875 Budget Clearing Account (Suspense) with Defense Finance and Accounting Services (DFAS).
- Make sure QRP sales proceeds are allocated to the QOC in accordance with 10 U.S.C. 2577.
- Determine whether the QRP Manager will negotiate direct sales agreements and whether those agreements will exceed \$15,000.
- Determine whether the QRP Manager will conduct commodity sales and also collect sales proceeds.
- Establish that sales proceeds will be payable to the U.S. Treasury and deposited by a government employee who is not the QRP Manager.

3.7 Records management and reporting

Establish a management control system that will assure the program meets its goals and properly accounts for government resources. The management control process should emphasize prevention of waste, fraud, and mismanagement and the timely correction of management control weaknesses. This system should be integrated into daily management practices. Several techniques to employ in the management control program are listed below. See Army internal controls guidance in AR 11-2¹⁵ for additional information.

¹⁵ AR 11-2, Army Managers' Internal Control Program (Washington, DC: Headquarters, Department of the Army, 4 January 2010).

- Develop an accounting and tracking program that will detail recyclable materials and QRP cash flow.
- Know contractor/tenant reporting requirements.
- Implement recycling material segregation policies for all recyclable materials and detail policies in contracts like a performance work statement (PWS).
- If sales will go through the DLA, then it is important to establish DLA disposition services turn-in procedures.
- Conduct regular (quarterly) recycling opportunity assessments for all recyclable commodities.
- Evaluate and/or monitor on a quarterly basis all recycling practices including procedures for storage, collection, segregation, and transportation as well as final disposition.
- If the GC decides to run recycling revenues through DLA instead of operating a direct sales QRP, then turn-in procedures must be provided using DD Form 1348-1A.
- Establish a recycling policy.
- The SOP should detail all processes performed at the QRP and cover the following:
 - Designation of a QRP Manager and duties of other installation staff offices that will support recycling.
 - Types of materials handled and how they will be recycled.
 - Specific implementation procedures.
 - Mechanisms for tracking and maintaining records of the types and amounts of materials handled.
 - Mechanism for tracking and maintaining accounting records of funds received and disbursed.

- Payment/transfer of operating expenses.
- Distribution of amounts remaining in the installation recycling account for authorized purposes.

3.8 QRP compliance checklist

After the QRP is set up, the following documentation must be maintained to comply with IMCOM policy:

- Recycling Policy: Installation policy that outlines recycling efforts.
- QRP SOP: Provides details on program procedures.
- QRP Business Plan: Provides comprehensive details and plans.
- Feasibility Study: Evaluates the economic feasibilities of operating a QRP.
- Market Analysis: Determines the financial benefits and/or losses associated with each eligible material.
- Waste Stream Analysis: Establishes the Installation's waste stream baseline and identifies recyclable materials.
- Facility/Building Representatives: List of QRP staff and/or points of contact (POCs) at recycling center.
- QRP- Operating or Oversight Committee (OC) Charter: Defines purpose, structure, and requirements of QRP-OC.
- QRP Manager Appointment Letter: QRPs must have an appointed program manager.
- DLA Letter of Agreement (LOA): Establishes that DLA will use the QRP LOA and the DoD Activity Address Code (DODAAC) for QRP eligible turn-ins.

3.9 Management controls

The following are the required management controls:

- Internal Audits: Required annually to review all QRP-related files, processes, and accounting.
- External Audits: Required every three years to review all QRP-related files, processes, and accounting.
- Management Control Reviews: Provides assurance that the QRP program meets its goals and properly accounts for government resources.
- Excluded Item Sales Controls: Must be in place to ensure only eligible materials are accepted and sold via the QRP.
- Protocols: Establish protocols that prevent the QRP from collecting recyclable materials that are prohibited by the Army or DoD regulations.

3.10 Recordkeeping

The following items comprise the required recordkeeping:

- QRP Subcommittee Meeting Minutes: Document past working group level meetings.
- QRP-OC Meeting Minutes: Document QRP-OC meetings.
- Annual Budget and Fund Disbursements: Documents decisions supporting use of proceeds by the QRP-OC or GC.
- List of Buyers: Lists the vetted buyers with which the QRP can do direct sales.
- Maintenance Records: Details facility maintenance costs, including equipment expenditures.
- Training/Certification: Acquired by taking QRP Management Courses.
- Operating and Overhead Costs: Record of operating costs including equipment purchases, labor, training, publicity, maintenance, and program operation.
- Cost Avoidance: Shows monetary savings in terms of weight/volume of material diverted from the waste stream.

- Retention of Records: Sales Documentation (DD Form 1348-1A) and sales receipts (Standard Form [SF] 1080s), which are required to maintain records for current fiscal year (FY) and two preceding FYs.

3.11 Responsibilities of Garrison Commander

The GC is tasked with doing the follow things:

- Designating a QRP Manager who has a good understanding of solid waste management, the recycling industry, materials recycled on post, contract administration, the rules and regulations associated with QRP recycling, the role of DLA, and budgeting. This person should also be able to account for all costs and revenues, be able to manage equipment and employees, and have a good understanding of all associated safety measures. Finally, (if pursuing direct sales of brass) the QRP Manager should have training on Material Potentially Presenting an Explosive Hazard (MPPEH) to ensure that improper materials are not sold when recycling fired brass and gleanings from firing ranges.
- Designating a QOC and a person to chair the QOC, which should meet quarterly. The primary objective of the committee is to advise the GC on program decisions, such as recycling program changes, facility improvements and equipment purchases, and excess recycling fund disbursements.
 - The QOC should consist of the QRP Manager, the installation executive officer, and a representative from each of the installation organizations mentioned here, including the RMO, Distribution Operations Center (DOC), DPW, Directorate of Logistics (DOL) Environmental Department management, Staff Judge Advocate (SJA), Safety Office, Public Affairs Office (PAO), Supply, Directorate of FMWR, Family Housing, DLA, tenant activity representatives, and the fire department.
 - The QOC is responsible for establishing objectives to maximize recycling and minimize solid waste disposal.

3.12 Responsibilities of DPW Director

The DPW's director is the functional manager for the ISWMP and does the following tasks:

- Plans collection, transportation, storing, and processing of recyclable materials.
- Champions the inclusion of provisions for green procurement and recycling in construction and demolition (C&D) (including renovations and remodeling) contracts.
- Develops and administers contracts that support the QRP, as directed by the Director of Contracting.
- Reports solid waste management data, including QRP data and tenant recycling data, to Headquarters Department of the Army (HQDA) using the web-based Solid Waste Annual Reporting (SWAR) data management system (SWARWeb).
- Acquires solid waste and recycling equipment.
- Supervises QRP operations, which include doing the following tasks:
 - Ensure that recycling revenues are used in accordance with 10 U.S.C. 2577.
 - Maintain the required accounting records.
 - Provide support for the documentation of all proceeds received from sales of recyclable materials and for the disbursement of funds for authorized purposes.
 - Ensure excluded materials are not sold through the QRP.

- Track and maintain records of quantities of recyclables sold and revenues gained from sales, including SWARWeb reporting,¹⁶ and in accordance with the Army's Qualified Recycling Program Handbook.¹⁷
- Procure equipment for QRP operations.
- Perform personnel management functions and proper training for QRP employees.
- Develop QRP SOPs, including safety procedures.
- Maintain an active education and promotion program.
- Monitor participation in the QRP.
- Maintain a list of contacts from each building or activity to assist in coordinating the QRP.
- Address customer complaints.
- Perform annual program reviews, including cost-benefit analyses.
- Advise the GC on QRP status.

¹⁶ SWARWeb Reporting (paragraph 8.8 from the *Qualified Recycling Program Handbook* [see footnote below): SWARWEB is the official Army system for collecting solid waste and recycling information. Installations are required to report all solid waste and recycling activity on a semi-annual basis through the chain of command to HQDA, using the Solid Waste Annual Report, Web-based (SWARWeb). Reports are due within 45 days after the end of the second and fourth quarters of the fiscal year. Managers of new construction, major renovation, facilities reduction or other demolition projects shall also report C&D waste activities to the designated installation Point of Contact for data entry to SWARWeb. Annual evaluation of an installation or activity's success, rated against the Department of Defense Pollution Prevention and Compliance Metrics, will be on the overall performance (total tons of recycled or diverted waste divided by the total tons of waste generated multiplied by 100) attained throughout the reporting period, as determined from the data reported in SWARWeb located at <https://www.acsim-apps.army.mil>.

The SWARWeb is accessible via the Installation Management Application Resource Center (IMARC) portal at <https://www.acsim-apps.army.mil>. User ID requests from installations are subject to approval by HQDA.

¹⁷ U.S. Army, *Qualified Recycling Program Handbook* (Washington, DC: U.S. Army Headquarters, Assistant Chief of Staff Installation Management [ACSIM], November 2010).

3.13 Responsibilities of QRP Manager

The QRP Manager is in charge of the following tasks:

- Maintaining all QRP direct sales records as well as all financial records from the inception of the QRP, including all operating, overhead, equipment, start-up costs, and financial avoidance records. The direct sales information should include item descriptions, sales price, payment date, weight of scrap sold, and sale dates.
- Retaining DLA Disposition Services records – which include the disposal turn-in documents (DD Form 1348-1A),¹⁸ sales receipts (SF 1080),¹⁹ and copies of payment checks for funds transfers.
- Reporting diversion metrics through SWARWeb. The SWARWeb is accessible via the Installation Management Application Resource Center (IMARC) portal.²⁰ The QRP will provide recycling information and data to the installation SWARWeb point of contact. The types of information that must be reported are material quantities, estimated costs, and cost avoidance.
- Making sure that solid waste (including materials separated for recycling) is stored such that it does not constitute a fire, health or safety hazard, or provide food or harborage for vectors, and is contained or bundled so as not to result in spillage.
- Recycling all federally mandated materials (e.g., newsprint, high-grade paper, and cardboard), where applicable.

¹⁸ Issue Release/Receipt Document

¹⁹ Voucher for Transfers Between Appropriations and/or Funds

²⁰ IMARC portal, <https://www.acsim-apps.army.mil/>

4 QRP-Eligible Materials

As mentioned in previous sections, not all recyclables are eligible for reimbursement under a QRP. DoDI 4715.23 presented an updated list of materials that are QRP-eligible, along with clarification on diversion criteria. Table 1 is an excerpt of information in the DoDI, and it presents materials and their classifications, and whether they are “DLA Disposition Services Eligible” and/or “Diversion metric eligible.” The label “DLA Disposition Services Eligible” refers to items that either may be or must be disposed through DLA. These items may or may not be QRP-eligible. On the other hand, “Diversion metric eligible” are items counted as diversion when they are diverted from a landfill. As of 2017, the overall DoD diversion goal is to divert 50% of solid waste generated. Based on this guidance, recyclable materials considered QRP eligible at Fort Huachuca would include old corrugated cardboard; paper and mixed paper; plastics #1–7; aluminum; fats, oils, and grease (FOG); scrap metal; and spent brass from ammunition 0.50 caliber and lower.

The QRP can accept materials from most military and civilian garrison activities and tenants. *Exceptions* include the following:

- Defense Commissary Agency (DeCA) and Army and Air Force Exchange Service (AAFES). Recyclable materials from DeCA Commissaries and AAFES establishments are potentially QRP eligible but only if there is a memorandum of understanding (MOU) stating that recyclables and sales proceeds are being donated to the QRP. As of 2015, the Commissary and Post Exchange (PX) at Fort Huachuca had their own recycling programs. Here is an opportunity for cooperation with the Garrison.
- Privatized Housing under the Residential Communities Initiative (RCI). In order to process recyclable materials from RCI housing through the QRP, there must be an agreement in place between the private housing manager and the installation QRP management. However, this agreement is optional, as the two parties are not obligated to work together and RCI housing recyclable materials are not required to be processed through the QRP. As of 2015, RCI housing at Fort Huachuca has an arrangement with the City of Sierra Vista for recycling collection.

A general rule of thumb is that if the installation's DPW currently pays for solid waste collection, then recyclables in that collection can go to the QRP and count toward that installation's diversion goals.

Table 1. Materials disposition and diversion eligibility guidance (from DoDI 4715.23).

Item	QRP Eligible	DLA Disposition Services Eligible	Diversion Metric Eligible	Notes
High-grade office paper	Yes	Yes	Yes	
Mixed office paper	Yes	Yes	Yes	
Newspaper print	Yes	Yes	Yes	
Corrugated cardboard	Yes	Yes	Yes	
Corrugated cardboard generated by commissaries or exchanges	Yes*	Yes	Yes	*QRP eligible only if a memorandum of understanding (MOU) is in effect with the local commissary or exchange stating they are donating the cardboard and any sales proceeds to the QRP. QRPs cannot return proceeds to commissaries or exchanges.
Plastics (recycling codes 1–7)	Yes	Yes	Yes	
Glass	Yes	Yes	Yes	
Aluminum and other metal cans	Yes	Yes	Yes	
Ferrous and nonferrous scrap metal	Yes	Yes	Yes	From other activities.
Scrap metal from DEMIL of ships, aircraft, or weapons	No	Yes	No	

Item	QRP Eligible	DLA Disposition Services Eligible	Diversion Metric Eligible	Notes
Scrap metal generated from activities supported by the working capital fund (WCF)	No	Yes	Yes	
Unserviceable appliances in scrap condition	Yes	Yes	Yes	Refrigerants must be recovered from refrigerators and air-conditioner units before sale. Chlorofluorocarbon (CFC) refrigerants should be turned in to the DLA Ozone Depleting Substance Reserve.
Expendable small arms cartridge casings (ESACCs); .50 caliber (12.7 mm and smaller	Yes	Yes	Yes	Options: (1) QRP must deform casings before direct sale, or (2) turn in to DLA Disposition Services with properly documented DD Form 1348-1A1 to receive sales proceeds.
Expendable casings larger than .50 caliber (12.7 mm)	No	Yes	Yes	Requires safety inspections and Demilitarization (DEMIL) (Code G items).
Mixed metal range gleanings	Yes	Yes	Yes	
Ammunition cans and boxes; scrap condition, unusable or unserviceable .50 caliber (12.7 mm) and smaller	Yes	Yes	Yes	
Ammunition cans and boxes; serviceable for intended use	No	Yes	Yes	

Item	QRP Eligible	DLA Disposition Services Eligible	Diversion Metric Eligible	Notes
Precious-metal bearing scrap	No	Yes	No	
Wooden pallets; unusable or unserviceable	Yes	No	Yes	
Wooden pallets; usable	No*	Yes	Yes	*QRP-eligible only with site-by-site DLA Disposition Services documented approval to determine as scrap.
Scrap wood	Yes	Yes	Yes	
Landscape trimmings	Yes	Yes	Yes*	*Grass clippings left in place is waste avoidance and not eligible for diversion credit. If collected and composted, include as diversion.
Food waste	Yes	No	Yes	
Excess food, donated	No	No	Yes	
Scrap furniture; broken, non- repairable, unusable, or unserviceable	Yes*	Yes	Yes	*QRP must sell as scrap metal, wood, or textile; cannot sell as usable furniture item. QRP must retain on file DLA Disposition Services abandonment or destruction certification.
Used furniture	No	Yes	Yes	
Uncontaminated rags and textiles	Yes	Yes	Yes	

Item	QRP Eligible	DLA Disposition Services Eligible	Diversion Metric Eligible	Notes
Cooking oil or grease	Yes	Yes	Yes*	*If used for waste-to-energy purposes, it is disposal, not diversion.
Used vehicle oil; non-hazardous (NH)	Yes	Yes	Yes*	*If used for waste-to-energy purposes, it is disposal, not diversion.
Used vehicle oil; Resource Conservation and Recovery Act hazardous	No	Yes	No	
Antifreeze; NH ethylene glycol- based	Yes	Yes	Yes	
Fuel sources	No	Yes	No	As defined in Section 2922e of Title 10, U.S.C.
Unopened containers of solvents, paints, or oil including expired and NH items	No	Yes	No	
Used tires; automotive and light truck	Yes	Yes	Yes*	*If used for waste-to-energy purposes, it is disposal, not diversion.
Used tires; aircraft	No	Yes	Yes*	*If recycled (not burned for waste- to-energy), it is considered diversion.
Fluorescent bulbs	Yes	Yes	No*	*Regulated as universal waste under federal regulations.
Compact fluorescent bulbs	Yes	Yes	No*	*Regulated as universal waste under federal regulations.

Item	QRP Eligible	DLA Disposition Services Eligible	Diversion Metric Eligible	Notes
Lead-acid batteries	Yes	Yes	No*	*Regulated as universal waste under federal regulations.
Government-purchased cell phone batteries (lithium-ion (rechargeable))	No	Yes	No*	*Regulated as universal waste under federal regulations.
Dry-cell batteries (includes: alkaline (non-rechargeable), carbon zinc (non-rechargeable), nickel cadmium (rechargeable), lithium (non-rechargeable), and lithium-ion (rechargeable))	Yes*	Yes	Yes*	*If NH and non-universal waste.
Spent toner cartridges	Yes	Yes	Yes	
Government-purchased cell phones	No	Yes	No	
Materials from building or structure deconstruction (copper wiring, unpainted wood waste, intact building components such as doors and windows)	Yes	Yes*	Yes**	*DLA Disposition Services does not accept broken window or glass. **Reportable as disposed or diverted C&D debris.
Materials from road or runway deconstruction (asphalt, concrete, metal rebar)	Yes	No*	Yes**	*DLA Disposition Services accepts metal rebar only when it is obtained from road or runway debris. **Reportable as disposed or diverted C&D debris.

Item	QRP Eligible	DLA Disposition Services Eligible	Diversion Metric Eligible	Notes
Government-purchased electronic components (includes information technology)	No	Yes	No	
Privately owned personal property; lost, abandoned, or unclaimed	No	Yes	No	
Privately owned personal property, donated for QRP disposal	Yes	No	No	
Nonappropriated fund (NAF) scrap or recyclables	Yes*	Yes	Yes*	*QRP eligible only when MOU with local commissary or exchange states the NAF is donating both the scrap items and sales revenue to the QRP.
Privatized MFH municipal solid waste	Yes*	No	Yes**	*Privatized Military Family Housing (MFH)-generated recyclables are QRP eligible, but not mandatory. QRP manager should review contract between privatized MFH management and the DoD Component for options to include reporting privatized MFH recyclables. **If QRP is processing privatized MFH recyclables and including them as an installation diversion, both disposal and diverted tonnages must be reported.

5 Recycling Potential at Fort Huachuca

Currently, Fort Huachuca does not recycle (other than family housing and some tenants). However, based on the 2015 WC performed by the ERDC-CERL Waste Team and reported to IMCOM in 2016, Fort Huachuca generates a number of materials in its waste stream that are QRP eligible. As of August 2017, the brass generated at Fort Huachuca is handled by the DLA based in Tucson, Arizona. For a list of the highest value recyclable materials generated at Fort Huachuca and for projections of recyclable generation rates, installation-wide, see Table 2. Table 2 also provides market values for recyclable materials, their approximate collection costs (based on the waste hauling contract), and net annual values.

Table 2. Installation-wide recyclable generation and costs (ERDC-CERL).

Material Type	Amount Generated (Tons/Year)	Market Value (\$/Ton)	Total Market Value (\$/Year)	Estimated Collection Cost (@ \$35/Ton)	Potential Net Value **
Plastic #1 (baled)	216	\$160	\$34,560	\$7,560	\$27,000
Plastic #2 (baled, pigmented)	58	\$260	\$15,080	\$2,030	\$13,050
Aluminum (baled)	78	\$700	\$54,600	\$2,730	\$51,870
Brass	6	\$3,500	\$21,470	\$210 *	\$21,260
Cardboard (baled)	450	\$77	\$34,731	\$15,750	\$18,981
Mixed paper (baled)	48	\$100	\$4,800	\$1,680	\$3,120
Newspaper (baled)	49	\$18	\$927	\$1,715	-\$787
Steel	95	\$50	\$4,750	\$3,325	\$1,425
White paper (baled)	463	\$120	\$55,560	\$16,205	\$39,355
Total	1,463		\$226,009	\$51,205	\$175,274

* Source: Supply and Services Division, Logistics Readiness Center, Fort Huachuca. See Section 6 of this report for a detailed discussion of brass recycling costs and benefits.

**Potential Net Value = market value minus collection cost

5.1 Overview of recyclable materials generated at Fort Huachuca

The recyclable materials and quantities shown in Table 2 are an accounting of the high-value recyclables at Fort Huachuca. Old corrugated cardboard, white paper, aluminum, steel, plastics #1–7, and brass are all recyclable materials that are generated at Fort Huachuca, however.

5.1.1 White paper

White paper (at 32%) represented the largest quantity of the high-value recyclables generated per year on the installation. By recycling white paper and diverting it from landfill, the installation could gain an estimated \$27k more per year. Please refer to 40 CFR 226.200 highlights in subsection 2.2.2 of this report for more specific guidelines on recycling paper.

5.1.2 Cardboard

Cardboard represented the second-largest quantity (31%) of the high-value recyclables generated at Fort Huachuca per year. Since Fort Huachuca generates approximately 450 tons of cardboard each year, the installation must recycle cardboard in order to remain compliant with federal code 32 CFR 246.202-1 (see subsection 2.2.2 of this report). Cardboard recycling at Fort Huachuca is expected to generate close to \$19k per year.

5.1.3 Aluminum

Aluminum was found to make up approximately 5.3% of the high-value materials found in the solid waste stream each year installation-wide. While this percentage may seem low, the 2017 market value for aluminum ranges from \$600–\$700 per ton. Aluminum recycling could provide the installation with an estimated \$44k–\$52k of additional funds per year.

5.1.4 Steel

Steel comprised approximately 6.5% of the high-value materials generated per year in the solid waste stream. Recycling steel can gain an estimated \$1,425 each year for the installation.

5.1.5 Plastic #1

Approximately 15% of the high-value recyclables generated per year at Fort Huachuca is #1 Plastic. This material represents the third-largest

quantity of high-value recyclables found in the installation's solid waste stream. Recycling #1 plastics could provide approximately \$27K of additional funds each year.

5.1.6 Plastic #2

Plastic #2 represented close to 4% of the high valued recyclables generated at Fort Huachuca per year. If recycled and diverted from landfill, this recyclable could provide approximately \$13K each year for the QRP.

5.1.7 Brass

Table 3 presents pounds of expended brass generated at Fort Huachuca for FY2012–FY2016. Because brass is a high-value commodity, Fort Huachuca can generate a modest income for a QRP from brass sales. In November 2017, the average price for scrap brass was \$1.49 per pound.²¹ Based on 2017 brass prices, Fort Huachuca's QRP could have received close to \$76,000 for sales of 51,000 lb of brass that accumulated over the five-year period (FY2012–FY2016).

Table 3. Expended brass turn-in data for Fort Huachuca (source: Supply and Services Division, Logistics Readiness Center, Fort Huachuca).

Fiscal Year	Expended Brass Turn-in per Type of Shell Casing (lb)					
	.50 caliber	5.56 mm	5.56 mm blank	9 mm	7.62 mm	Annual Total
2012	1,660	13,960	4,080	0	0	19,700
2013	0	3,940	0	0	0	3,940
2014	0	10,820	2,280	0	0	13,100
2015	2,120	6,540	0	3,680	0	12,340
2016	*	*	*	*	1,920	1,920

*Indicates some shell-size data is not available.

5.2 Recommended recyclable materials

Given federal recycling policies, quantities generated at Fort Huachuca, and market values, it makes sense for Fort Huachuca to focus recycling efforts on white paper (mandatory under certain parameters, see Subsection

²¹ www.recycleinme.com, accessed November 2017. RecycleInMe is a leading online scrap trading portal deal with 200+ sorts of metal and scraps.

2.2.2), cardboard (mandatory under certain parameters, see Section 2.2), mixed paper, aluminum cans, steel cans, #1 and #2 plastics, and brass. Table 4 shows the recommended materials to collect and their values.

Table 4. Suggested recyclables to collect at Fort Huachuca (ERDC-CERL).

Material Type	Amount Generated at Fort Huachuca (tons/year)	Market Value (\$/ton)	Total Market Value (\$/year)	Estimated Collection Cost (@ \$35/ton)	Potential Net Revenue
Plastic #1 (baled)	216	\$160	\$34,560	\$7,560	\$27,000
Plastic #2 (baled, pigmented)	58	\$260	\$15,080	\$2,030	\$13,050
Aluminum (baled)	78	\$700	\$54,600	\$2,730	\$51,870
Brass	6	\$3,500	\$21,470	\$210	\$21,260
Cardboard (baled)	450	\$77	\$34,731	\$15,750	\$18,981
Mixed paper (baled)	48	\$100	\$4,800	\$1,680	\$3,120
Steel	95	\$50	\$4,750	\$3,325	\$1,425
White paper (baled)	463	\$120	\$55,560	\$16,205	\$39,355
Totals	1414	—	\$225,081	\$49,490	\$176,061

6 Recycling Options for Spent Brass

As discussed above, spent brass from .50 caliber and lower shells is QRP eligible, but because all spent brass is considered MPPEH, it must be prepared for sale according to specific guidelines. Thus, it must be inspected by a person trained to certify brass as “material documented as safe” (MDAS). Once deemed MDAS, the brass is ready for transfer either to DLA or to a QRP for direct sales. Brass intended for direct sales must be crushed or deformed to prevent re-loading. Spent brass larger than .50 caliber is NOT QRP eligible and MUST be turned over to DLA. Intact brass (i.e., not deformed) can be sold only through DLA.

6.1 Option 1: Brass sales through DLA

Fort Huachuca’s current practice to send installation brass that is recyclable to DLA. The benefits of this process are that DLA coordinates all the logistics, paperwork, and safety certifications. The drawbacks of using DLA sales are that the brass prices achieved through DLA are usually lower than open market prices, and reimbursement from DLA to the QRP can take several months. In fact, in a 2017 memo, DLA put FY2017 reimbursements on hold, pending a review of their accounting systems.²²

6.2 Option 2: Direct sales by QRP

At U.S. Army training ranges, the spent brass casings must be retrieved from the field and turned in to the ASP. As mentioned above, all brass casings .50 caliber and below that are recycled through the QRP must be deformed before they are sold on the open market. This deformation can be done with a type of machine called an “expanded shell ordinance casings deformer” (EOCD).

The standard QRP turn-in Form DD 1348 is used to keep track of all the materials that go through the QRP. In the case of brass, the form will track the brass from the hand-off at the ammunition supply point (ASP) and back to the QRP. One person associated with QRP management should be

²² Defense Logistics Agency, Memorandum for Qualified Recycling Program Managers (Battle Creek, MI: DLA Disposition Services, 12 July 2017).

responsible for overseeing the brass that goes through the QRP and should safety-certify the brass listed on Form DD 1348.

A typical process for handling brass on installations is as follows:

1. Soldiers pick up munition casings from the field (ranges) and bring them to the ASP.
2. After the munitions are sorted, the ASP representative weighs each category.
3. Next, a Quality Ammunition and Surveillance Assurance Specialist (QASAS) verifies the amounts and types and that prescribed handling procedures are followed.
4. Then the DD 1348 is filled out for the brass quantities, and the form is signed by someone from the ASP and someone from QRP management.
5. Brass is now ready for demilitarization.
6. Once an adequate quantity of brass has accumulated, QRP management can contact the vendors with whom they have sales agreements.
7. QRP management will then fill out a brass pick-up receipt that must accompany every vehicle picking up the brass.
8. Trucks weigh in empty (except for pallets) and weigh out again when full; specific information must be recorded by the QRP for every truck-load of brass (e.g., #of pallets, tractor #, trailer #, and license plate #).
9. Both QRP management and the truck driver receive copies of brass pick-up receipts.

6.3 QRP Feasibility

While brass is a relatively valuable commodity, the cost to prepare brass for market is also high. For a QRP program to directly sell brass, the value of the brass must be weighed against the one-time cost of safety certification equipment and the recurring O&M cost (labor and utilities) that must be paid by the QRP. Therefore, for direct sales of brass, the volume generated must be great enough to offset the costs. Unfortunately, a return on investment (ROI) analysis shows that direct sales of brass through the QRP is not economical for Fort Huachuca. Table 5 gives a summary of the calculations that went into the ROI analysis. More detail is shown in this report's Appendix, including photos and prices of the equipment required (Figure A1 and Figure A2).

Table 5. Projected ROI for brass direct sales (ERDC-CERL).

Cost / Benefits	Brass \$ unit
ROI payback period	(never)
Gross annual income	\$21,000
Annual cost	\$27,000
NET INCOME (avoided costs & savings)	\$(6,000)
QUANTITY OF RECYCLING	6 tons/yr.
Capital purchase, safety certification unit	\$146,000
Labor (to install)	2,400 40 hours
Connection to utilities at site	10,000
Staff time for coordination, contracting, etc.	10,000 3 weeks
Training and travel (4 people)	34,000 2 weeks TDY*
Purchase brass deformer	73,000
ONE-TIME COSTS	\$275,400
DPW Staff labor (2 weeks)	\$6,000 2 weeks
O&M Labor, Gov't (2 people)	\$10,000 2 weeks
Service calls	N/A
Contractor labor	N/A
Periodic training (2 people)	\$5,000 1 week
Parts	\$5,000
Electricity for deformer	\$164
Propane for Safety Certifier	\$1,320
Annual Costs	\$27,484

TDY = temporary duty

7 Optimizing Collection Strategy

This section presents possible strategies for efficient collection of recyclables at Fort Huachuca and increased profits for QRP management. It does this by evaluating the following three potential scenarios:

Scenario #1: Collection from all buildings. This is accomplished by examining the whole installation block by block to determine optimum placement and number of exterior collection containers. There are two sub-scenarios: Scenario 1A for collection via contractor and Scenario #1B for collection via DPW staff.

Scenario #2: Collection from specific building types. This scenario shows tables that categorize installation buildings by type (i.e., all office buildings, all instructional buildings, all industrial buildings, etc.) to determine which building types generate the most recyclables.

Scenario #3: Collection from specific buildings. This scenario identifies the individual buildings with the highest projected recyclable generation rates.

For all three scenarios, quantities and example costs for interior and exterior containers are provided. Then, an ROI is calculated for each.

Because Fort Huachuca does not have a recycling program currently, it makes sense to begin the program with the recyclables that either have the highest market value or that federal regulation requires to be recycled. These recommended recyclables are as follows: office paper (mandatory under certain circumstances, see Section 2.2), cardboard (mandatory under certain circumstances, see Section 2.2), aluminum cans, steel cans, and #1 and #2 plastics.

7.1 Scenario #1: Collection from all buildings

If the intention is to collect recyclables post-wide, this scenario strategizes the most central building pick up locations (with a minimum of collection sites). The most efficient way to determine number of collection points is to identify the buildings that must be individually serviced and then map the groups of buildings that can share containers. Certainly, the goal is to provide complete recycling pick-up coverage while minimizing the number

of collection locations a recycling truck has to visit. Table 6 considers the Fort Huachuca map, block by block, and suggests locations for recycling collection. Note here that Section 7.1 applies to both Scenarios #1A and #1B. See Appendix A for ROI calculations for these two sub-scenarios.

While Scenario #1 assumes installation-wide recycling, it attempts to minimize the number of pickups by identifying groups of buildings that can share exterior recycling bins. Thus, it is important here to consider a building's generation rates for each recyclable. Buildings that generate low numbers of recyclables will be aggregated with buildings that generate high numbers of recyclables. In this scenario, exterior recycle bins will be placed closest to the building with the highest numbers of recyclables. For yet greater efficiency this scenario assumes a minimum of three external containers: one each for white paper and cardboard, and one for the collection of aluminum, plastic, and steel containers, which will either be commingled in one container or source separated in one compartmentalized container with three slots.

Based on the Scenario #1 analyses, the recommended minimum number of building and building group locations is 84. See Table 6 for suggested exterior container locations.

The quantity and placement of interior recycling bins are also considered for Scenario #1. Table 7 gives the overall cost of both interior and exterior containers. See Appendix A and Table A1 for a more detailed explanation and listing of the number of interior and exterior bins for this scenario.

When considering this scenario, it is not only important to determine the quantities of recyclables generated at each site (as discussed above), but it is also necessary to take into account the time an outdoor container will take to fill. This time will determine the container size required for a specific building location and the frequency of container pick up. Table 7 lists the costs and the types of containers Fort Huachuca can use for recycling collection. The costs are calculated according to the number of interior and exterior containers recommended here for each building, and are based on building type and size. Figure 1, Figure 2, and Figure 3 show the types of containers and prices that were used for Table 7 calculations. Table 8 projects Scenario #1 total values for recyclables across the installation. For detail by building of interior and exterior container numbers and their costs, see discussion of Scenario #1 in Appendix A.

Table 6. Suggested recycling container exterior locations (ERDC-CERL).

Block Number	Container Locations (closest building #)	Block Number	Container Locations (closest building #)
154	79	573	05
211	12	574	28
222	14	616	10
223	26	617	30
224	10	618	01, 09
225	26	627	18, 22, 50, 02, 04
300	10	638	45
301	15	639	02, 20
310	44	676	01
311	22	705	25
413	30	728	05
414	08, 15, 20	758	01
450	05, 01	759	02
451	03	800	11
468	02	801	22
471	21	803	05
481	01	804	05
482	28	805	05, 03, 04
490	13, 55	807	06
500	10	813	05
510	05, 01	814	05
511	02	815	02
512	01	820	12
513	01	825	02
514	51	828	12
520	PX, 56, 60, 65	844	02
521	01, 10, 36, 07, 04	852	02
522	04	853	02
523	13	863	02
533	01, 20	911	12

Block Number	Container Locations (closest building #)	Block Number	Container Locations (closest building #)
553	50	912	51
563	01		

Table 7. Cost of recycling containers according to the recommended number of interior and exterior containers based on building type and size (ERDC-CERL, 2017).

Container	Quantity	Cost Each	Total Cost per Type Container
64 gallon toter for office paper, exterior	380	\$129	\$49,067
64 gallon toter for plastic and metal containers, commingled, exterior	380	\$129	\$49,067
4-yard dumpsters for cardboard, exterior	111	\$900	\$99,900
23-gallon office paper interior	1949	\$14.85	\$28,940
23-gallon, mixed containers, interior	1949	\$14.85	\$28,940
TOTAL All Container Costs			\$255,913

Figure 1. Example of recycling container that could be used at Fort Huachuca (priced at GSA Advantage).²³

Enlarge/More Views >>

\$120.29 EA
sold and shipped by
HARDWARE INC
visit contractor's website

64GAL 2WHL RECYC CART

Mfr Part No.: 25564-05BLU
Contractor Part No.: 138993
Manufacturer: TOTER INCORPORATED
Contract No.: GS-21F-0104W (ends: Feb 29, 2020)
MAS Schedule/SIN: 51V/105 002
Warranty: 30 DA
Made In: UNITED STATES OF AMERICA
Weight: 28.000 LB

DISAST Disaster Purchasing Items

Desc

TOTER INCORPORATED, 64GAL 2WHL Recyc Cart, 64 Gallon, 2 Wheel, Blue Recycle Cart, With Attached Lid, Manufactured Using Medium Density Polyethylene & Up To 50% Recycled Content, Fully Recyclable, Wheel Make It Easier To Tilt & Roll. *Please contact us toll free at 1-877-944-4610 or by e-mail mro@hardwareincnola.com for additional product information.

²³ https://www.gsaadvantage.gov/advantage/catalog/product_detail.do?gsin=11000030198650

Figure 2. Example exterior container for cardboard (manufactured by Global Industrial).

Figure 3. Example interior recycling bin (manufactured by Grainger).

Table 8. Total value of recyclables (ERDC-CERL).

Material Type	Market Value (per ton)	Installation - Wide Quantity (ton/year)	Total Value
Plastic #1 (baled)	\$160	219	\$35,019
Plastic #2 (baled, pigmented)	\$260	58	\$15,145
Aluminum (baled)	\$700	79	\$55,323
Cardboard (baled)	\$125	454	\$56,701
Mixed paper	\$100	50	\$4,968
Steel	\$160	114	\$18,193

Material Type	Market Value (per ton)	Installation - Wide Quantity (ton/year)	Total Value
White paper (baled)	\$120	491	\$58,925
TOTAL		1,464	\$244,273

7.2 Scenario #2: Recyclable collection by building type

To establish generation of recyclables by building type, two tables were created, with data drawn from the ERDC-CERL Fort Huachuca waste characterization study. Table 9 shows the expected annual generation of recyclables by each building for all the buildings at Fort Huachuca. The rows list building types, and the columns show the predicted annual weight of a specific recyclable material. Table 10 shows the value of the recyclables generated per year by building type. The purpose of these two tables is to identify the building types that produce the highest weight of recyclables as well as those recyclables with the greatest value. The tables show that general information buildings (GIB) and dining facilities (DFAC), training barracks, PXs, and tactical equipment maintenance facility (TEMFs) produce the most recyclables in terms of both total weight and value. Table A4 in the Appendix gives a complete list of buildings and containers used for calculations used in this scenario.

Table 9. Annual recyclable generation amounts at Fort Huachuca for all buildings by building type (ERDC-CERL).

Building Type	Weight (tons) by Recyclable Type per Building							Total Recycl. per Bldg (tons)
	#1	#2	Aluminum	Corrugated Cardboard	Mixed Paper	Steel Cans (Fe)	White Paper	
GIB	151.96	28.6	42.9	113.71	17.85	49.35	398.49	802.86
DFAC	0.98	5.23	6.15	154.22	0.12	12	2.15	180.85
PX	9.02	9.80	2.25	51.47	0.75	0.75	1.80	75.84
TEMF	12.53	2.00	2.34	36.31	0.16	4.00	12.61	69.95
Training Barracks	14.85	5.32	10.08	27.22	3.72	0.00	4.24	65.43
Infosys	6.71	1.52	3.03	8.01	15.15	1.3	14.07	49.79
GPW	1.3	0.49	0.49	21.77	7	7.05	11.24	49.34
CDC	1.12	0.87	0.38	15.53	0.13	12.2	0.62	30.85
Religious	12.53	0.30	7.45	0.40	1.19	0.00	0.30	22.17

Building Type	Weight (tons) by Recyclable Type per Building							Total Recycl. per Bldg (tons)
	#1	#2	Aluminum	Corrugated Cardboard	Mixed Paper	Steel Cans (Fe)	White Paper	
UEPH	2.75	2.97	1.27	9.03	0.21	2.33	0.21	18.77
Outpatient Health Center (OHC)	0	0	0	0	0	0	13.44	13.44
Retail Supermarket	0.29	0.00	0.87	3.13	0.67	0.00	2.97	7.93
Office - small	0.51	0.06	0.12	0	0.34	5.88	0.06	6.97
COF	0.99	0.4	0.59	3.43	0.2	0	0.99	6.6
Healthcare - Hospital	0	0	0	5.66	0	0	0	5.66
PFF	0.65	0.08	0.08	0.00	0.89	0.08	0.08	1.86

GPW = general purpose warehouse; CDC = Child Development Center; UEPH = unaccompanied personnel housing; COF = Company Operations facility; and PFF = physical fitness facility.

Table 10. Recyclable values generated per year by building type (ERDC-CERL).

Building Type	Value of Recyclable Type per Building Type							Total Annual Value, (per bldg. type)
	#1 Plastic	#2 Plastic	Aluminum Cans	Corr. Cardboard	Mixed Paper	Steel Cans	White Paper	
GIB	\$24,314	\$7,436	\$30,030	\$14,214	\$1,785	\$7,896	\$47,819	\$133,493
DFAC	\$157	\$1,360	\$4,305	\$19,278	\$12	\$1,920	\$258	\$27,289
Training Barracks	\$2,376	\$1,383	\$7,059	\$3,403	\$372	\$0	\$509	\$15,102
PX	\$1,443	\$2,548	\$1,578	\$6,434	\$75	\$119	\$216	\$12,413
TEMF	\$2,005	\$520	\$1,635	\$4,539	\$16	\$640	\$1,513	\$10,869
Infosys	\$1,074	\$395	\$2,121	\$1,001	\$1,515	\$208	\$1,688	\$8,002
Religious	\$2,004	\$78	\$5,216	\$50	\$119	\$0	\$36	\$7,504
GPW	\$208	\$127	\$343	\$2,721	\$700	\$1,128	\$1,349	\$6,576
CDC	\$179	\$226	\$266	\$1,941	\$13	\$1,952	\$74	\$4,652
UEPH	\$440	\$771	\$886	\$1,129	\$21	\$372	\$25	\$3,645
Outpatient Health Center (OHC)	\$0	\$0	\$0	\$0	\$0	\$0	\$1,613	\$1,613
Retail supermarket	\$46	\$0	\$608	\$391	\$67	\$0	\$357	\$1,470

Building Type	Value of Recyclable Type per Building Type							Total Annual Value, (per bldg. type)
	#1 Plastic	#2 Plastic	Aluminum Cans	Corr. Cardboard	Mixed Paper	Steel Cans	White Paper	
COF	\$158	\$104	\$413	\$429	\$20	\$0	\$119	\$1,243
Office - small	\$82	\$16	\$84	\$0	\$34	\$941	\$7	\$1,163
Healthcare - Hospital	\$0	\$0	\$0	\$708	\$0	\$0	\$0	\$708
PFF	\$103	\$20	\$55	\$0	\$89	\$13	\$10	\$290

7.3 Scenario #3: Collection from specific buildings

Scenario #3 drills deeper into projected recyclable generation at the individual building level to target specific buildings for recycling collection, in order to get the most value for the collection effort. In short, this scenario identifies both the buildings from which recycling should be collected as well as the buildings from which recycling should NOT be collected. The downside for this approach is that the recycling message might seem inconsistent to soldiers and employees (i.e., recycling in some buildings and not in others).

Table 11 identifies the buildings at Fort Huachuca that are projected to produce the greatest quantities of each recommended recyclable material.²⁴ The blue cells highlight recyclable generation rates in the top ten across the installation. For example, building #11640 is shown to be one of the top 10 for generating #1 plastic and white paper. Looking down each column, notice there are 10 highlighted cells for each recyclable material, and these cells correspond to the top 10 quantities of each material.

Not only do these 25 buildings generate proportionally large amounts of recyclables, but also they account for close to half the revenue projected from recyclables for the entire installation (refer to Table 4 for total projected revenues).

²⁴ Please recall that these figures are merely projections based on a one-week waste characterization study.

When planning pick-up schedules, it is most cost effective to make one trip to a building to collect all the recyclables rather than making several trips to pick up source-separated recyclables. Therefore, when calculating overall value of recyclables collected, the values for all the materials generated at a specific building were included. See Table 12 for potential market values for all the buildings and recyclables listed in Table 11. For a more detailed building list, refer to Table A6 in Appendix A, which shows the different sections and functions of large buildings and the number of containers to assign to each.

Table 11. Top 25 buildings for project recyclable generation (ton/year) (ERDC-CERL).

Bldg. #	Organization	#1 plastic	#2 plastic	Al	Old Corrugated Cardboard (OCC)	Mixed paper	Steel Can	White Paper
11640	2-13 AVN REGT	5.40	1.02	1.52	4.04	0.63	1.75	14.16
45001	RAYMOND W. BLISS CLINIC	0.00	0.00	0.00	5.66	0.00	0.00	26.42
48101	CDC, FMWR	0.38	0.30	0.13	5.33	0.04	4.19	0.21
49055	CDC, FMWR	0.29	0.23	0.10	4.04	0.03	3.17	0.16
51005	HHC USAICoE	4.24	1.30	2.35	6.52	0.90	0.76	4.90
52030	MAIN EXCHANGE	4.26	4.62	1.06	24.29	0.36	0.36	0.85
52056	CYS SERVICES, FMWR	0.45	0.35	0.15	6.17	0.05	4.84	0.25
52107	BDE HHC THEAT TAC SIG	0.14	0.76	0.89	22.30	0.02	1.74	0.31
53301	TECHNOLOGY INTERGRATION CENTER	0.49	0.11	0.23	0.59	1.11	0.10	1.03
53302	TECHNOLOGY INTERGRATION CENTER	0.49	0.11	0.23	0.59	1.11	0.10	1.03
55350	EPG	0.53	0.12	0.24	0.64	1.20	0.10	1.12
57305	DISA JOINT INTEROP TEST CMD SPT	1.20	0.27	0.54	1.43	2.71	0.23	2.51
57428	DISA JOINT INTEROP TEST CMD SPT	0.74	0.17	0.34	0.89	1.68	0.14	1.56
61801	ACT USA SIGNAL NETWOR	6.23	1.36	2.16	6.86	3.25	12.55	11.57
61809	CO B 305 MI BN	20.60	3.88	5.82	15.41	2.42	6.69	54.03
61820	305 MI BN	7.37	1.39	2.08	5.51	0.86	2.39	19.32
63845	CTR USA INT CEN & FT	10.21	1.92	2.89	7.65	1.25	3.31	26.77
63902	CO A 305 MI BN	20.32	3.82	5.73	15.13	2.44	7.76	53.03
70525	THUNDER MOUNTAIN ACTIVITY CENTER	0.27	1.41	1.66	41.58	0.03	3.24	0.58
80122	CO D 306 MI BN	9.42	1.77	2.66	7.05	1.10	3.06	24.71
80503	REAL PROPERTY, DPW	0.13	0.68	0.80	19.99	0.02	1.56	0.28

Bldg. #	Organization	#1 plastic	#2 plastic	Al	Old Corrugated Cardboard (OCC)	Mixed paper	Steel Can	White Paper
80504	REAL PROPERTY, DPW	0.13	0.68	0.80	20.16	0.02	1.57	0.28
80505	CO A 304 MI BN	12.62	2.37	3.56	9.44	1.48	4.10	33.08
85202	AIT Complex	0.29	1.55	1.83	45.74	0.04	3.56	0.64
91122	2-13 AVN REGT	5.29	1.00	1.49	3.96	0.62	1.72	13.87

Table 12. Projected market value of recyclables at the top-producing buildings (ERDC-CERL).

Material Type	Market Value (\$/Ton)	Total Mkt. Value
Plastic #1 (baled)	\$160	\$17,837
Plastic #2 (baled, pigmented)	\$260	\$8,108
Aluminum (baled)	\$700	\$27,478
Cardboard (baled)	\$125	\$35,118
Mixed paper	\$100	\$2,339
Steel	\$160	\$11,036
White paper (baled)	\$120	\$35,119
TOTAL		\$137,035

8 Summary: Costs and Benefits of Three Scenarios for a QRP

8.1 Economic evaluation, with scenarios

Table 13 provides an analysis of the costs and benefits for each recycling scenario listed below:

- Scenario #1A: Collection from all buildings via contractor labor.
- Scenario #1B: Collection from all buildings via DPW staff.
- Scenario #2: Collection by building type.
- Scenario #3: Collection from specific buildings.

Table 13 highlights seven cost and benefit concerns: (1) net income, (2) gross annual savings per building, (3) quantity of recycling, (4) income, (5) one-time costs, (6) annual costs, and (7) avoidance costs. Taken together, these cost-benefit concerns paint a comprehensive picture of the main operational costs and benefits to consider when implementing an installation recycling program.

While there are benefits to all the scenarios, the two scenarios that will generate the highest net income for Fort Huachuca are Scenarios #1A and #2. The net income difference between Scenarios #1A and #2 is \$1,000 and their ROIs differ by just three years. Scenario #1B generates a net income of \$16,000, which is \$38,000 less than the incomes produced by #1A and #2; Scenario #3 has a net income of \$41,000, which is \$10,000 less than either #1A or #2 incomes.

More specifically, while #1A has higher income, #1A also has higher collection costs and although #2 collection costs are lower than those of #1A, #2 also generates lower income. Thus, the costs for both scenarios result in similar incomes. Although the marginal rate of return per investment is highest for Scenario #3 (because it proposes recycling only from the buildings that generate the greatest numbers of recyclables), Scenarios #1 and #2 -generate more revenue because they propose collecting more recyclables from more buildings.

Finally, Scenario #1B, which requires the greatest investment, offers the lowest returns and has the highest ROI. This finding is because the costs in Scenario #1B include all the implementation and maintenance expenses required to set up and operate an in-house recycling facility.

For more detail on these cost calculations, see this report's Appendix.

Table 13. ROI summary for collection scenarios (ERDC-CERL).

Input Variables	Scenario #1A: Collection from All Bldgs (320 bldgs.)	Scenario #1B: Collection from All Bldgs. (in-house recycling; 320 bldgs.)	Scenario #2: Collection by Bldg. Type. (93 bldgs.)	Scenario #3: Collection from Specific Bldgs. (25 bldgs.)
ROI (years)	8.14	35.01	5.16	4.25
Gross annual savings	\$207,000	\$207,000	\$157,000	\$116,000
Annual cost	\$155,000	\$191,000	\$106,000	\$75,000
NET INCOME (avoided costs & savings)	\$103,000	\$16,000	\$51,000	\$41,000
NET ANNUAL INCOME PER BLDG	\$322	\$50	\$548	\$1,640
Annual recycling (ton/year)	1,025	1,025	776	590
Value of recyclables (70% capture)	\$171,000	\$171,000	\$129,000	\$95,000
Cost of containers & ma- chinery (indoors & out- doors)	\$270,000	\$390,000	\$157,000	\$96,000
Labor cost (to place new containers)	\$19,000	\$19,000	\$9,600	\$4,800
Connection to utilities at site	N/A	\$30,000	N/A	N/A
Contracting	\$14,000	\$14,000	\$14,000	\$14,000
Outreach (initiating recy- cling program)	\$20,000	\$20,000	\$20,000	\$20,000
Labels (for new contain- ers)	\$98,000	\$98,000	\$58,000	\$39,000
ONE TIME COSTS	\$421,000	\$571,000	\$258,600	\$173,800
Labor	\$43,200	\$43,200	\$28,800	\$14,400
O&M Labor Gov't (full- time)	N/A	\$120,000	N/A	N/A
Outreach	\$19,000	\$19,000	\$7,200	\$7,200
Hauling Costs	\$93,000	N/A	\$70,000	\$53,000
Additional Costs (hauling recyclables)	N/A	\$-	N/A	N/A

Input Variables	Scenario #1B: Collection from All Bldgs. (in-house recycling; 320 bldgs.)			
	Scenario #1A: Collection from All Bldgs (320 bldgs.)	Scenario #2: Collection by Bldg. Type. (93 bldgs.)	Scenario #3: Collection from Specific Bldgs. (25 bldgs.)	
Liquid Fuels	N/A	\$8,125	N/A	N/A
ANNUAL COSTS	\$155,200	\$190,325	\$106,000	\$74,600
Hauling Costs	N/A	\$-	N/A	N/A
Tipping Fees	\$36,000	\$36,000	\$27,000	\$21,000
AVOIDANCE COSTS	\$36,000	\$36,000	\$27,000	\$21,000

8.2 Summary of scenario advantages and disadvantages

Table 14 provides lists of the advantages and disadvantages for each of the different recycling scenarios.

Table 14. Recycling collection pros and cons, compared by scenario (ERDC-CERL).

Scenario	Pros	Cons
1A	<ul style="list-style-type: none"> • Serves 100% of the installation • Maximum collection of recyclables • Highest net income 	<ul style="list-style-type: none"> • High implementation cost
1B	<ul style="list-style-type: none"> • The recycling program services 100% of the installation for maximum collection of recyclables 	<ul style="list-style-type: none"> • Highest implementation costs • Longest ROI payback period • Lowest net income • Highest annual costs • Lowest marginal return for investment
2	<ul style="list-style-type: none"> • Highest gross annual savings per building • Consistency among building types 	<ul style="list-style-type: none"> • Low diversion rates
3	<ul style="list-style-type: none"> • Quickest ROI • Greatest marginal return for investment • Lowest implementation costs • Lowest annual costs 	<ul style="list-style-type: none"> • Lowest diversion rates • Lowest income • Lowest net income • Inconsistent implementation from a user perspective

A QRP would be feasible for Fort Huachuca by following Scenarios 1A, 2, or 3, as described above. In selecting which plan to implement, the installation must balance diversion goals against potential revenue. Because the goal of an installation recycling program is to maximize diversion rates and generate enough revenue from the sale of recyclables to support its recycling program, Scenario #1A: “Collection from All Buildings” is recommended for Fort Huachuca. This scenario proposes contractor-based, installation-wide recycling, (i.e., there are none of the expensive implementation costs associated with the running of an in-house recycling program). Scenario #1A is recommended over Scenarios #2 and #3 because it has the potential for higher diversion rates and is likely to net greater total revenues for Fort Huachuca. In addition, Scenario #1A will provide a consistent recycling experience across the installation.

However, if the Garrison would prefer gradually rolling out recycling, Scenario #3 is preferable because it is easiest to implement and offers the quickest payback and highest return per dollar invested.

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Appendix A: General Method for Recyclable Material Projection

Quantity projections

ERDC-CERL performed a detailed waste characterization at Fort Huachuca, with the goals of determining waste generation factors and quantities of materials available for recycling. These waste factors (or “intensities”) were calculated for each building type and for each of the 19 waste types (paper, aluminum, plastics, etc.). The idea was to develop generation factors so that waste generation could be extrapolated across all installation buildings. Further, in order to compare waste generate between buildings of different sizes, the waste intensities were expressed per unit of occupied floor area (i.e., pounds per square foot per day).

After waste generation factors were calculated, they were applied to all the buildings at Fort Huachuca. In this way, the expected daily quantities generated for each waste type was calculated. Once calculations were completed, it became time to think strategically about where to focus recycling efforts. For example, it might be important to know which buildings are the top 20 generators of cardboard.

For Scenario #1, recycling collection from all buildings, a spreadsheet model developed by ERDC-CERL gives a tally of the total quantity and value for each recycling commodity. For Scenarios #2 and #3, the spreadsheet prioritizes which buildings to service, based on expected recycling generation at each building. In addition, for Scenario #2 the spreadsheet both groups and sums the generation of recyclables by building type (e.g., barracks or DFAC). This capability enables the user to determine which building types are the top generators of recycling. Scenario #3, on the other hand, takes a more granular look, building by building, to determine and sort the list of buildings expected to generate the most recycling. After the buildings that are best for recycling in each scenario has been determined, then it is time to compute the potential material sales revenues possible for each scenario.

ROI calculations

The ROI calculations in this report were performed with an additional spreadsheet model developed by ERDC-CERL in support of IMCOM's P2 program. Three types of costs go into this model, as listed below:

1. *Detailed annual costs* based on the current ways of doing business to address specific issues like waste management; these costs includes labor, utilities, repairs, waste disposal, etc.
2. *Implementation costs* for a proposed new process (in this case, implementing a recycling program); these costs include capital costs, equipment installation, and staff time for contracting and coordination.
3. Finally, *projected annual costs and revenues* for the proposed process.

To determine the simple payback time in years (i.e., how long will the new process take to pay back the initial investment), it is necessary to divide the net annual savings expected with the new process by the total of the new process's implementation costs.

Scenario #1 building list

Table A1 lists the suggested number of interior and exterior recycling containers at each building that is included in Scenario #1.^{25,26} The dark horizontal lines help to delineate each block. These container numbers were derived in the following ways:

- Each block must have at least one set of exterior collection containers (one each for cardboard, office paper, and commingled drink containers, and one for commingled plastic and aluminum drink containers).
- Each building must have at least one set of interior collection containers (a set here consists of one container for office paper and one container for commingled plastic and aluminum drink containers).
- Same number of exterior paper and drink bins per block of buildings.

²⁵ This method of calculation and table data apply to both scenarios #1A and #1B.

²⁶ This method of calculation applies to all scenarios.

- Same number of interior paper and drink bins per building.
- Building types of general purpose warehouse (GPW), physical fitness facility (PFF), PX, and TEMF were assigned one set of interior bins per 5,000 ft² area.
- All other building types were assigned one set of interior bins per 2,000 ft² area.

Table A1. Scenario #1 building list with number of recycling containers needed (ERDC-CERL, with building information provided by Fort Huachuca DPW).

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
15423		SPORTSMANS CENTER, FMWR	Office-Small		0	0	1	1
15424		RANGE CONTROL	Office-Small		0	0	1	1
15425		RANGE CONTROL	Office-Small		0	0	1	1
15430		RANGE CONTROL	Office-Small		0	0	1	1
15471		GOLF COURSE, FMWR	TEMF - T		0	0	1	1
15472		GOLF COURSE, FMWR	TEMF		0	0	1	1
15475		GOLF COURSE, FMWR	TEMF		0	0	1	1
15476		GOLF COURSE, FMWR	TEMF		0	0	1	1
15477		MOUNTAIN VIEW GOLF COURSE	TEMF		0	0	1	1
15479		MOUNTAIN VIEW GOLF COURSE	PX	2	1	1	2	2
15482		GOLF COURSE, FMWR	TEMF		0	0	1	1
15483		GOLF COURSE, FMWR	TEMF		0	0	1	1
15491		SHOPPETTE / MAIN GATE	PX	1	1	1	1	1
21112		Wayland Baptist University	GIB		0	0	2	2
21112		ACAP	GIB	1	1	1	1	1
21115		Public Affairs Office	Office-Small	0	1	1	2	2
21115		Public Affairs Office	Office-Small		0	0	1	1
22208		DPW, USAG FT HUACHUCA	ARC		0	0	3	3

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
22208		HHD 111 MI BDE	BDEHQ		0	0	2	2
22208		6TH CID REG	COF		0	0	1	1
22208		ACCAPG	Office-Medium		1	1	4	4
22212		USAG FT HUACHUCA	ARC		0	0	1	1
22214		MWR	Office-Medium		1	1	4	4
22214		CPAC (MER Branch)	Office-Small		1	1	1	1
22216		REAL PROPERTY, DPW	Office-Medium	1	1	1	6	6
22320		USA CPAC FT HUACHUCA	Office-Medium	1	1	1	6	6
22322		USA CPAC FT HUACHUCA	GIB		0	0	1	1
22324		NEC Command Center	INFOSYS		0	0	1	1
22324		Judge Advocate Generals	Office-Small		0	0	1	1
22326		Safety Office	Office-Small	1	1	1	1	1
22328		EQUAL EMPLOYMENT OPPORTUNITY	Office-Small		0	0	2	2
22334		USA AVN COE	BNHQ		1	1	2	2
22336		18TH MP DET	COF		0	0	2	2
22404		TDY STUDENTS-BILLET LOAD (SCHOOL CODE 307)	UEPH		0	0	1	1
22408		FLD OFC FT HUACHUCA	GPW		0	0	1	1
22408		DOL FT HUACHUCA AZ	GPW		0	0	1	1
22408		DOL FT HUACHUCA AZ	Office-Small		0	0	2	2
22408		FLD OFC FT HUACHUCA	Office-Small		0	0	1	1
22408		FLD OFC FT HUACHUCA	Office-Small		0	0	1	1
22414		TDY STUDENTS-BILLET LOAD (SCHOOL CODE 307)	GIB		1	1	4	4
22414		REAL PROPERTY, DPW	GPW	1	1	1	2	2
22414		REAL PROPERTY, DPW	GPW		0	0	1	1

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
22414		TDY STUDENTS-BILLET LOAD (SCHOOL CODE 307)	GPW		0	0	1	1
22414		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
22414		ARMY SUBSTANCE ABUSE PROGRAM	OHC		1	1	4	4
22418		REAL PROPERTY, DPW	Office-Small		0	0	2	2
22422		DPW, USAG FT HUACHUCA	Office-Medium		1	1	6	6
22422		DOL FT HUACHUCA AZ	Office-Small		0	0	1	1
22526		OPS & MAINT, DPW	Office-Medium	1	1	1	4	4
22528		DPW, USAG FT HUACHUCA	ARC		0	0	4	4
22530		DPW, USAG FT HUACHUCA	TEMF	1	1	1	3	3
22534		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
22542		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
22543		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
30009		FT HUACHUCA VET BRANCH	OHC		0	0	1	1
30010		FT HUACHUCA VET BRANCH	OHC	1	1	1	1	1
30015		USDA-Forest Service	OHC		0	0	1	1
30018		ENG/HOUSE MNT (HVAC)	TEMF		0	0	1	1
30020		SUPPLY / YARD 8, DPW	GPW		0	0	1	1
30023		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
30024		REAL PROPERTY, DPW	GPW		0	0	1	1
30031		EMCOR	TEMF		0	0	1	1
30033		EMCOR	TEMF		0	0	1	1
30113		CTR USA INT CEN & FT	GPW		0	0	1	1
30114		USA OPTEC TEXCOM IEWT DIR	TEMF		0	0	1	1
30115		GAN	TEMF	1	1	1	1	1

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
30118		DOL FT HUACHUCA AZ	GPW		0	0	2	2
30118		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
30118		111TH MI BDE	GPW		0	0	1	1
30118		FT HUACHUCA MUSEUM, FMWR	GPW		0	0	1	1
30134		EMCOR	TEMF		0	0	2	2
30138		CO D 306 MI BN	GIB		1	1	3	3
30157		MWR	Religious		0	0	1	1
31008		MAIN EXCHANGE	GPW		0	0	1	1
31008		DPW, USAG FT HUACHUCA	GPW		0	0	1	1
31013		DES, USAG FT HUACHUCA	GIB		1	1	2	2
31022		25 MP DET	COF		1	1	3	3
31032		USAG HHC CO HQ	COF		0	0	1	1
31043		DES, USAG FT HUACHUCA	ARC		0	0	1	1
31044		OFFICE OF INSPECTOR GENERAL	Office-Small	1	1	1	1	1
31114		DPW, USAG FT HUACHUCA	TEMF		0	0	1	1
31122		DES, USAG FT HUACHUCA	ARC		0	0	1	1
31122		USAG FT HUACHUCA	ARC		0	0	1	1
31122		18TH MP DET	COF	1	1	1	3	3
31122		MPI	Office-Medium		1	1	5	5
31122		DPTMS	Office-Small		1	1	3	3
31122		DACP	Office-Small		0	0	1	1
31122		Physical Security (DES)	Office-Small		0	0	1	1
31122		UPH HOUSING, DPW	UEPH	1	2	2	10	10
41305		FT HUACHUCA MUSEUM, FMWR	Religious		0	0	3	3
41330		ADJUTANT GENERAL	Office-Medium	1	1	1	4	4
41401		FT HUACHUCA MUSEUM, FMWR	Religious		1	1	4	4
41402		USAG CMD HQ	Office-Small		0	0	2	2
41407		USAG RESOURCE MANAGEMENT	GPW		0	0	1	1

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
41407		USAG RESOURCE MANAGEMENT	Office-Small		0	0	2	2
41408		DRM ORG E	Office-Medium	1	1	1	5	5
41411		US ARMY INTELLIGENCE MUSEUM	Religious		1	1	3	3
41412		CO D 306 MI BN	GIB		1	1	5	5
41415		DOL FT HUACHUCA AZ	Office-Small	1	1	1	2	2
41415		TRAINING AND DEVELOPMENT	Office-Small		0	0	2	2
41416		CO D 306 MI BN	GIB		2	2	6	6
41418		TRADOC-Capability Mgr. for Intel Sensor	GPW		0	0	1	1
41418		OCMI - Office of the Chief Mil Intel	GPW		0	0	1	1
41418		TRADOC-Capability Mgr for Intel Sensor	Office-Medium		1	1	4	4
41419		TRADOC-Capability Mgr for Intel Sensor	Office-Medium		1	1	7	7
41420		111TH MI BDE	BDEHQ	1	1	1	2	2
41420		111TH MI BDE	GPW		0	0	1	1
41420		MPO (Defense Military Pay)	Office-Medium		1	1	4	4
41420		USAG FT HUACHUCA	Office-Small		0	0	1	1
41421		DHR, USAG FT HUACHUCA	GPW		0	0	2	2
41421		ACAP	Office-Small		0	0	1	1
45001		RAYMOND W. BLISS CLINIC	Healthcare - Hospital	2	9	9	44	44
45004		EMCOR	GPW		0	0	1	1
45005		W3ZU USA DENTAL ACT	OHC	1	1	1	6	6
45006		RAYMOND W. BLISS CLINIC	OHC		1	1	7	7
45022		Medical Warehouse	GPW		0	0	3	3
45103		Myer School	GIB	2	3	3	15	15
46802		Community Center	Community	2	3	3	15	15
47121		Elementary School	GIB	2	3	3	15	15
48101		CDC, FMWR	CDC	2	2	2	11	11
48228		Middle School		2	3	3	15	15

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
49013		YOUTH SERVICE	PFF	2	1	1	4	4
49055		CDC, FMWR	CDC	2	2	2	8	8
50010		ARMY CMTY SVC	Office-Medium	1	1	1	4	4
50025		DPW, USAG FT HUACHUCA	Religious		0	0	1	1
51001		BN 5TH BN, 104TH REGT	BNHQ	1	1	1	6	6
51001		BND GEN FORCE ARMY BA	GIB		2	2	5	5
51001		UPH HOUSING, DPW	Training Barracks		2	2	10	10
51005		HHC USAICoE	BNHQ		1	1	4	4
51005		902nd MI GP	COF		0	0	2	2
51005		CO E 2-13 Avn Regt	COF		0	0	1	1
51005		Learning Innovation	GIB		1	1	3	3
51005		ARNG	Office-Small		1	1	3	3
51005		ITRADS	Office-Small		0	0	2	2
51005		Judge Advocate Generals	Office-Small		0	0	1	1
51005		W3ZU USA DENTAL ACT	OHC		0	0	1	1
51005		111TH MI BDE	Training Barracks	1	9	9	45	45
51005		CO E 2-13 Avn Regt	Training Barracks		5	5	27	27
51028		FIRE STATION #1	TEMF		1	1	1	1
51101		MEDDAC	OHC		1	1	4	4
51102		USA TRIAL DEF SVC FT HUACHUCA	Office-Medium	1	1	1	4	4
51201		KINO CHAPEL	Religious		1	1	3	3
51301		MWR	Religious	1	3	3	14	14
51406		DES, USAG FT HUACHUCA	GPW		0	0	1	1
51419		DES, USAG FT HUACHUCA	GPW		0	0	1	1
51420		ACT USA SIGNAL NETWORK	GPW		0	0	1	1
51421		MISSION SUPPORT DIRECTORATE	GPW		0	0	1	1
51424		REAL PROPERTY, DPW	TEMF		0	0	1	1

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
51427		REAL PROPERTY, DPW	TEMF		0	0	1	1
51428		REAL PROPERTY, DPW	TEMF		0	0	1	1
51432		REAL PROPERTY, DPW	TEMF		0	0	1	1
51437		BDE HHC THEAT TAC SIG	GPW		0	0	1	1
51450		AAFES	TEMF		0	0	2	2
51451		11 SC BDE HHC	TEMF	2	2	2	1	1
51452		REAL PROPERTY, DPW	GIB		0	0	1	1
51453		REAL PROPERTY, DPW	TEMF		0	0	1	1
51454		REAL PROPERTY, DPW	Office-Small		0	0	1	1
51455		REAL PROPERTY, DPW	Office-Small		0	0	1	1
51456		REAL PROPERTY, DPW	TEMF		0	0	1	1
51457		REAL PROPERTY, DPW	TEMF		0	0	1	1
51458		REAL PROPERTY, DPW	TEMF		0	0	1	1
52008		CRAFT CENTER, FMWR	TEMF	1	1	1	2	2
52010		BOWLING CENTER, FMWR	PFF	1	1	1	5	5
52025		GAME STOP	PX	1	0	0	1	1
52030		MAIN EXCHANGE	PX	2	3	3	15	15
52038		SHOPPETTE / CLASS VI	PX	2	0	0	1	1
52040		POST OFFICE FT HUACHUCA	Office-Small		0	0	2	2
52045		Launderette	PX	1	0	0	1	1
52048		PX FURNITURE / OUTDOOR LIVING	PX	2	0	0	3	3
52056		CYS SERVICES, FMWR	CDC	2	2	2	12	12
52060		MAIN CHAPEL	Religious		2	2	10	10
52065		Michaels Military Housing	Office-Medium		1	1	3	3
52065		FAMILY HOUSING ADMINISTRATION	Office-Small		0	0	1	1

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
52065		DOL FT HUACHUCA AZ	Office-Small		0	0	1	1
52101		HHC 40 SC BN	BNHQ	1	0	0	3	3
52101		MFLC, 11 SC BDE	BNHQ		0	0	1	1
52101		CECOM	BNHQ		0	0	1	1
52104		ARMY EDUCATION CENTER	GIB	1	2	2	6	6
52107		BDE HHC THEAT TAC SIG	DFAC	2	1	1	6	6
52110		REAL PROPERTY, DPW	BNHQ	1	1	1	6	6
52111		CYS SERVICES, FMWR	Office-Small		1	1	3	3
52120		40 SC BN	BNHQ		1	1	5	5
52131		UPH HOUSING, DPW	UEPH		2	2	8	8
52132		UPH HOUSING, DPW	UEPH		1	1	6	6
52136		Soldier Community Bldg.	Religious	1	1	1	5	5
52137		UPH HOUSING, DPW	UEPH		1	1	6	6
52138		UPH HOUSING, DPW	UEPH		2	2	8	8
52141		UPH HOUSING, DPW	UEPH		1	1	6	6
52142		UPH HOUSING, DPW	UEPH		1	1	6	6
52204		Safety Office	Office-Small		0	0	1	1
52204		Union	Office-Small		0	0	1	1
52204		UPH HOUSING, DPW	Training Barracks	1	4	4	18	18
52204		REAL PROPERTY, DPW	Training Barracks		0	0	1	1
52208		REAL PROPERTY, DPW	Office-Small		0	0	1	1
52220		FAMILY FITNESS CENTER	PFF		0	0	1	1
52307		REAL PROPERTY, DPW	COF		1	1	4	4
52308		REAL PROPERTY, DPW	BNHQ		1	1	4	4
52308		11 SC BDE HHC	GPW		1	1	2	2
52308		WTU	Training Barracks		1	1	6	6
52308		11 SC BDE HHC	UEPH		4	4	22	22
52309		CO A 40 SC BN	COF		0	0	2	2
52309		HHC 40 SC BN	COF		0	0	2	2

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
52309		11 SC BDE HHC	UEPH		6	6	28	28
52310		CO C 40 SC BN	COF		0	0	2	2
52310		CO B 40 SC BN	COF		0	0	2	2
52313		BDE HHC THEAT TAC SIG	UEPH	1	1	1	1	1
53301		TECHNOLOGY INTERGRATION CENTER	INFOSYS	1	4	4	19	19
53302		TECHNOLOGY INTERGRATION CENTER	INFOSYS		4	4	19	19
53310		CMD USA INFO SYS ENGR	GPW		0	0	2	2
53320		BDE HHC THEAT TAC SIG	COF	1	2	2	9	9
53321		BDE HHC THEAT TAC SIG	COF		1	1	6	6
55340		CMD USA INFO SYS ENGR	INFOSYS		0	0	2	2
55350		EPG	INFOSYS	1	4	4	20	20
56301		EPG	INFOSYS	1	3	3	14	14
56307		EPG	INFOSYS		0	0	2	2
57305	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	5	5
57305		DISA JOINT INTEROP TEST CMD SPT	INFOSYS	1	8	8	41	41
57428	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	B	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	C	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	D	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	E	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	F	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	4	4
57428		DISA JOINT INTEROP TEST CMD SPT	INFOSYS	1	2	2	8	8
57430	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS	1	1	1	5	5
57430	B	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	5	5

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
57430		DISA JOINT INTEROP TEST CMD SPT	INFOSYS		0	0	1	1
57431		DISA JOINT INTEROP TEST CMD SPT	INFOSYS		0	0	1	1
57434		DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57435		DISA JOINT INTEROP TEST CMD SPT	INFOSYS		0	0	1	1
57437		DISA JOINT INTEROP TEST CMD SPT	GPW		0	0	1	1
57439	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		0	0	2	2
57439	B	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	4	4
57439		DISA JOINT INTEROP TEST CMD SPT	TEMF		0	0	1	1
61610		FT HUACHUCA DEFENSE COMMISSARY AGENCY	Retail-Supermarket	4	7	7	36	36
61701		FT HUACHUCA FMWRF	PFF		2	2	10	10
61730		W1E8AA CTR USA INT CEN & FT-04289	GIB		1	1	4	4
61730		W1E8AA CTR USA INT CEN & FT-04289	Office-Large	1	5	5	27	27
61730		TRADOC Culture Center	Office-Small		0	0	2	2
61801		WODA83 AMC/ASC LOGISTICS SUPPORT TEAM OVERHIRES	BNHQ		0	0	1	1
61801		DIS DISTRIBUTED LEARNING SYSTEM	GIB		0	0	2	2
61801		ACT USA SIGNAL NETWORK	GIB		0	0	2	2
61801		CTR USA CIV PERS OPS	GIB		0	0	1	1
61801		CTR USA CIV PERS OPS	GIB		0	0	1	1
61801		Communications Security Logistics Activity (CSLA)	GIB		0	0	1	1
61801		CECOM	GIB		0	0	1	1

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
61801		NETCOM	GPW		1	1	4	4
61801		C-TNOSC	INFOSYS		3	3	14	14
61801		ACT USA SIGNAL NETWORK	INFOSYS		1	1	7	7
61801		CMD USA INFO SYS ENGR	INFOSYS		1	1	6	6
61801		DPTMS, USAG FT HUACHUCA	INFOSYS		0	0	2	2
61801		NETCOM	INFOSYS		0	0	1	1
61801		NETCOM	Office-Large	1	15	15	76	76
61801		Communications Security Logistics Activity (CSLA)	Office-Medium		3	3	17	17
61801		ACT USA SIGNAL NETWORK	Office-Medium		2	2	12	12
61801		CTR USA CIV PERS OPS	Office-Medium		2	2	11	11
61801		C-TNOSC	Office-Medium		2	2	11	11
61801		CMD USA INFO SYS ENGR	Office-Medium		1	1	7	7
61801		ACC	Office-Medium		1	1	6	6
61801		CECOM	Office-Medium		1	1	5	5
61801		ISEC	Office-Medium		1	1	5	5
61801		ACCAPG	Office-Small		1	1	3	3
61801		W6UX RCERT 1 (CONUS)	Office-Small		1	1	3	3
61801		REAL PROPERTY, DPW	Office-Small		1	1	3	3
61801		CTR USA INT CEN & FT	Office-Small		0	0	1	1
61801		OPM INVESTIGATIVE SVC	Office-Small		0	0	1	1
61801		CCIU TEAM C	Office-Small		0	0	1	1
61801		C-TNOSC	OHC		1	1	3	3
61801		AAFES	PX	2	1	1	2	2
61801		NETCOM	Religious		1	1	4	4
61801		SJA USAISC	Religious		0	0	1	1
61809		CO B 305 MI BN	GIB	1	11	11	55	55
61820		305 MI BN	GIB		4	4	20	20
62702		CO C 304 MI BN	GIB	1	3	3	16	16
62703		CO B 305 MI BN	GIB		1	1	3	3
62703		CO A 305 MI BN	GIB		0	0	2	2

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
62703		CTR USA INT CEN & FT	GIB		0	0	1	1
62704		CTR USA INT CEN & FT	GIB	1	2	2	8	8
62711		CTR USA INT CEN & FT	Office-Medium		2	2	9	9
62712		CISAC	GIB		2	2	9	9
62715		CO A 309 MI BN	GIB		1	1	3	3
62718		NCO ACADEMY	BDEHQ	1	0	0	1	1
62718		NCO ACADEMY	Training Barracks		6	6	31	31
62722		NCO ACADEMY	GIB	1	3	3	13	13
62723		TRAINING MATERIALS SUPPORT BRANCH	GPW		0	0	2	2
62723		MILITARY INTELLIGENCE LIBRARY	Office-Medium		1	1	3	3
62750		CECOM	INFOSYS	1	1	1	7	7
63845		CTR USA INT CEN & FT	GIB	1	5	5	27	27
63845		CTR USA INT CEN & FT	INFOSYS		0	0	1	1
63902		CO A 305 MI BN	GIB	2	5	5	23	23
63902		304TH MI BN	GIB		3	3	16	16
63902		NCO ACADEMY	GIB		3	3	13	13
63902		CO E, HUMINT CMTE, CI DIVISION	GIB		0	0	1	1
63902		USAICS COE	Office-Large		3	3	17	17
67601		Cochise College		2	3	3	15	15
70525		THUNDER MOUNTAIN ACTIVITY CENTER	DFAC	2	2	2	12	12
72805		BN EXPEDITIONARY SIG	TEMF	1	1	1	5	5
75801		40 SC BN	TEMF	1	1	1	2	2
75805		40 SC BN	TEMF		0	0	2	2
75807		40 SC BN	GPW		0	0	1	1
75901		DOL FT HUACHUCA AZ	TEMF		0	0	3	3
75902		DOL FT HUACHUCA AZ	TEMF	1	1	1	2	2

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
75903		DOL FT HUACHUCA AZ	TEMF		0	0	2	2
80011		CMD GLOBAL NETWORK EN	GIB		0	0	1	1
80011		CO D 306 MI BN	INFOSYS	1	1	1	4	4
80012		REAL PROPERTY, DPW	Religious		0	0	1	1
80022	A	CO E, HUMINT CMTE, CI DIVISION	GIB		2	2	10	10
80023	A	CO E, HUMINT CMTE, CI DIVISION	GIB		1	1	3	3
80122		CO D 306 MI BN	GIB	2	5	5	25	25
80305		CO A 2-13 AVN REGT	COF		0	0	2	2
80305		CO A 2-13 AVN REGT	UEPH	2	4	4	21	21
80306		CO E 305 MI BN	COF		0	0	1	1
80306		CO D 305 MI BN	UEPH		4	4	21	21
80405		DPW, USAG FT HUACHUCA	Office-Small		0	0	1	1
80405		CO A 213th	Training Barracks	1	3	3	14	14
80405		Marines Detachment	Training Barracks		2	2	8	8
80406		CO D 305 MI BN	Training Barracks	1	4	4	18	18
80406		UPB Branch	Training Barracks		1	1	5	5
80501		MILITARY CLOTHING STORE	PX	2	0	0	2	2
80503		REAL PROPERTY, DPW	DFAC	2	1	1	6	6
80504		REAL PROPERTY, DPW	DFAC	2	1	1	6	6
80505		CO A 304 MI BN	GIB		6	6	28	28
80505		CO B 304 MI BN	GIB		2	2	5	5
80706		USA OPTEC TEXCOM IEWT DIR	INFOSYS	1	3	3	14	14
81305		CO B 305 MI BN	Training Barracks	1	3	3	17	17
81305		CO A 305 MI BN	Training Barracks		2	2	9	9
81401		305 MI BN	BNHQ		0	0	3	3

Building Info				Containers				
Building No.	Bldg # Exten.	Organization	Building Type	Exterior Cardboard	Exterior Paper	Exterior Drink	Interior Paper	Interior Drink
81405		CO B 305 MI BN	Training Barracks	1	2	2	9	9
81405		316 TRNG SQD, USAF	Training Barracks		1	1	6	6
81501		USAG	OHC		0	0	1	1
81502		111TH MI BDE	BDEHQ	1	1	1	1	1
82012		TRAINING MATERIALS SUPPORT BRANCH	Office-Small		2	2	9	9
82013		TRAINING MATERIALS SUPPORT BRANCH	INFOSYS		0	0	1	1
82502		MAINT FMX FHFO	TEMF	1	1	1	5	5
82812		EPG	INFOSYS	1	1	1	5	5
84402		CO B 309 MI BN	Training Barracks	1	8	8	39	39
84410		DPW, USAG FT HUACHUCA	Religious		0	0	1	1
85202		AIT Complex	DFAC	2	3	3	13	13
85302		09L CO 309 MI BN PP	BNHQ		1	1	5	5
86302		CO A 309 MI BN	Training Barracks	1	8	8	39	39
86310		DPW, USAG FT HUACHUCA	Religious		0	0	1	1
86332		CO F 309 MI BN	Training Barracks	1	8	8	39	39
91110		CO E 305 MI BN	TEMF		1	1	7	7
91110		AIR TRAFFIC CONTROL	TEMF		0	0	1	1
91111		AIR TRAFFIC CONTROL	GPW		0	0	1	1
91112		2-13 AVN REGT	BNHQ	1	1	1	2	2
91112		2-13 AVN REGT	PFF		0	0	1	1
91114		2-13 AVN REGT	TEMF		1	1	6	6
91114		160 SC BDE DUIC	TEMF		0	0	1	1
91122		2-13 AVN REGT	GIB	1	3	3	14	14
91225		2-13TH AVN BN	GPW		0	0	1	1
91251		DPTMS, USAG FT HUACHUCA	ARC	1	1	1	2	2
91253		FIRE STATION #3	TEMF		0	0	1	1
91277		DOL FT HUACHUCA AZ	GPW		0	0	1	1

ROI Scenario #1A

The groupings of spreadsheets in Table A2 represent the ROI and supporting calculations for Scenario #1A.

Table A2. ROI Scenario #1A (ERDC-CERL).

PAYBACK PERIOD	8.14 years
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	\$ Current Practice	\$ New option	Net Annual savings
One-time cost	N/A	\$421,851	
Annual cost	N/A	\$(51,797)	\$51,797

Item	\$ Current Practice	\$ Proposed Project	\$ Net annual project cost, by line item	\$ Net annual project savings, by line item
One-time costs for new option				
Capital purchase, recycling containers, whole installation		\$269,791		
Labor to set out containers (2 months)		\$19,200		
Connection to utilities, site		\$-		
Staff time for coordination, contracting, etc. (1 month)		\$14,400		
Outreach to installation, materials		\$20,000		
Labels for bins @ \$20 ea.		\$98,460		
Annualized costs				
<i>Labor</i>				
DPW staff labor (3 months)	N/A	\$43,200	\$43,200	N/A
O&M labor, gov't	N/A	N/A	N/A	N/A
Service calls	N/A	N/A	N/A	N/A
Contractor labor	N/A	N/A	N/A	N/A
Periodic training, outreach (2 months)	N/A	\$19,200	\$19,200	N/A
<i>Parts</i>				
Consumables	N/A	N/A	N/A	N/A
Parts	N/A	N/A	N/A	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net annual project cost, by line item	\$ Net annual project savings, by line item
<i>Utilities</i>				
Electricity	N/A	N/A	N/A	N/A
Natural gas	N/A	N/A	N/A	N/A
Potable water	N/A	N/A	N/A	N/A
Sanitary sewer	N/A	N/A	N/A	N/A
Liquid fuels	N/A	N/A	N/A	N/A
<i>Waste</i>				
Avoided tipping fees (1464 tons @ \$35/ton) * 70% recovery rate	N/A	\$(35,868)	N/A	\$35,868
Additional cost for hauling recyclables (1464 tons @ \$90.42/ton) * 70% recovery rate	N/A	\$92,662	\$92,662	N/A
Hazardous waste handling and disposal	N/A	N/A	N/A	N/A
<i>Environmental Compliance</i>				
Staff time for permitting	N/A	N/A	N/A	N/A
Fees	N/A	N/A	N/A	N/A
<i>Vehicle Use (cost to gov't)</i>				
Fuel cost	N/A	N/A	N/A	N/A
Security	N/A	N/A	N/A	N/A
Pavement maintenance	N/A	N/A	N/A	N/A
<i>Other</i>				
Market value of recyclables (70% recovery)	N/A	\$(170,991)	N/A	\$170,991
Misc. 2	N/A	N/A	N/A	N/A
Misc. 3	N/A	N/A	N/A	N/A
Misc. 4	N/A	N/A	N/A	N/A
Misc. 5	N/A	N/A	N/A	N/A
TOTAL Project Implementation Cost		\$421,851		
Total Annual Cost & Savings	\$-	\$(51,797)	\$155,062	\$206,859

ROI Scenario #1B

The groupings of spreadsheets in Table A3 represent the ROI and supporting calculations for Scenario #1B.

Table A3. ROI Scenario #1B (ERDC-CERL).

PAYBACK PERIOD	35.01 years
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	\$ Current Practice	\$ New option	Net Annual savings
One-time cost		\$571,851	
Annual cost	N/A	\$(16,334)	\$16,334

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
One-time costs for new option				
Capital purchase, recycling containers, whole installation + 2 balers + 1 forklift + recycling collection truck		\$389,791		
Labor to set out containers (2 months)		\$19,200		
Connection to utilities, site		\$30,000		
Staff time for coordination, contracting, etc. (one month)		\$14,400		
Outreach to installation, materials		\$20,000		
Labels for bins @ \$20 ea.		\$98,460		
Annualized costs				
<i>Labor</i>				
DPW Staff labor (three months)	N/A	\$43,200	\$43,200	N/A
O&M Labor, Gov't, 3 people, full time @ \$20/hr. (NAF?)	N/A	\$120,000	\$120,000	N/A
Service calls	N/A	N/A	N/A	N/A
Contractor labor	N/A	N/A	N/A	N/A
Periodic training, outreach (2 months)	N/A	\$19,200	\$19,200	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
<i>Parts</i>				
Consumables	N/A	N/A	N/A	N/A
Parts	N/A	N/A	N/A	N/A
<i>Utilities</i>				
Electricity	N/A	N/A	N/A	N/A
Natural gas	N/A	N/A	N/A	N/A
Potable water	N/A	N/A	N/A	N/A
Sanitary sewer	N/A		N/A	N/A
Liquid fuels	N/A	\$8,125	\$8,125	N/A
<i>Waste</i>				
Avoided tipping fees (1464 tons @ \$35/ton) * 70% recovery rate	N/A	\$(35,868)	N/A	\$35,868
Additional cost for hauling recyclables (1464 tons @ \$90.42/ton) * 70% recovery rate	N/A	N/A	N/A	N/A
Hazardous waste handling and disposal	N/A	N/A	N/A	N/A
<i>Environmental Compliance</i>				
Staff time for permitting	N/A	N/A	N/A	N/A
Fees	N/A	N/A	N/A	N/A
<i>Vehicle Use (cost to gov't)</i>				
Fuel cost	N/A	N/A	N/A	N/A
Security	N/A	N/A	N/A	N/A
Pavement maintenance	N/A	N/A	N/A	N/A
<i>Other</i>				
Market value of recyclables (70% recovery)	N/A	\$(170,991)	N/A	\$170,991
Misc. 2	N/A	N/A	N/A	N/A
Misc. 3	N/A	N/A	N/A	N/A
Misc. 4	N/A	N/A	N/A	N/A
Misc. 5	N/A	N/A	N/A	N/A
TOTAL Project Implementation Cost		\$571,851		
Total Annual Costs & Savings		\$(16,334)	\$190,525	\$206,859

Scenario #2 building list

Table A4 shows all the buildings (and associated collection containers) described in Scenario #2, “Collection from Specific Building Types” (e.g., DFAC, GIB, TEMF, PX, and training barracks). Note that there are a few other building types that appear in this table. This is because some buildings are used for a number of different functions and therefore, some buildings are considered to be more than one building type. It is important to remember that, when collecting from a given building, it makes sense to collect from all areas of that building.

Table A4. Buildings in Scenario #2 and collection containers required (ERDC-CERL, using building information from Fort Huachuca DPW).

Building Info				Containers				
Bldg.#	Bldg.# Ext.	Organization	Building Type	Exterior OCC	Exterior Paper	Exterior Other	Interior Paper	Interior Other
11640		2-13 AVN REGT	GIB	1	1	1	6	6
11640		2-13 AVN REGT	GIB	2	2	2	9	9
15471		GOLF COURSE, FMWR	TEMF		0	0	1	1
15472		GOLF COURSE, FMWR	TEMF		0	0	1	1
15475		GOLF COURSE, FMWR	TEMF		0	0	1	1
15476		GOLF COURSE, FMWR	TEMF		0	0	1	1
15477		MOUNTAIN VIEW GOLF COURSE	TEMF		0	0	1	1
15479		MOUNTAIN VIEW GOLF COURSE	PX	2	1	1	2	2
15482		GOLF COURSE, FMWR	TEMF		0	0	1	1
15483		GOLF COURSE, FMWR	TEMF		0	0	1	1
15491		SHOPPETTE / MAIN GATE	PX	1	1	1	1	1
21112		Wayland Baptist University	GIB		0	0	2	2
21112		ACAP	GIB	1	1	1	1	1
22322		USA CPAC FT HUACHUCA	GIB		0	0	1	1
22414		TDY STUDENTS-BILLET LOAD (SCHOOL CODE 307)	GIB		1	1	4	4
22414		REAL PROPERTY, DPW	GPW	1	1	1	2	2
22414		REAL PROPERTY, DPW	GPW		0	0	1	1
22414		TDY STUDENTS-BILLET LOAD (SCHOOL CODE 307)	GPW		0	0	1	1
22414		DPW, USAG FT HUACHUCA	GPW		0	0	1	1

Building Info				Containers				
Bldg.#	Bldg.# Ext.	Organization	Building Type	Exterior OCC	Exterior Paper	Exterior Other	Interior Paper	Interior Other
22414		ARMY SUBSTANCE ABUSE PROGRAM	OHC		1	1	4	4
22530		DPW, USAG FT HUACHUCA	TEMF	1	1	1	3	3
30018		ENG/HOUSE MNT (HVAC)	TEMF		0	0	1	1
30031		EMCOR	TEMF		0	0	1	1
30033		EMCOR	TEMF		0	0	1	1
30114		USA OPTEC TEXCOM IEWT DIR	TEMF		0	0	1	1
30115		GAN	TEMF	1	1	1	1	1
30134		EMCOR	TEMF		0	0	2	2
30138		CO D 306 MI BN	GIB		1	1	3	3
31013		DES, USAG FT HUACHUCA	GIB		1	1	2	2
31114		DPW, USAG FT HUACHUCA	TEMF		0	0	1	1
41412		CO D 306 MI BN	GIB		1	1	5	5
41416		CO D 306 MI BN	GIB		2	2	6	6
45103		Myer School	GIB	2	3	3	15	15
47121		Elementary School	GIB	2	3	3	15	15
51001		BN 5TH BN, 104TH REGT	BNHQ	1	1	1	6	6
51001		BND GEN FORCE ARMY BA	GIB		2	2	5	5
51001		UPH HOUSING, DPW	Training Barracks		2	2	10	10
51005		HHC USAICoE	BNHQ		1	1	4	4
51005		902nd MI GP	COF		0	0	2	2
51005		CO E 2-13 Avn Regt	COF		0	0	1	1
51005		Learning Innovation	GIB		1	1	3	3
51005		111TH MI BDE	Training Barracks	1	9	9	45	45
51005		CO E 2-13 Avn Regt	Training Barracks		5	5	27	27
51028		FIRE STATION #1	TEMF		1	1	1	1
51424		REAL PROPERTY, DPW	TEMF		0	0	1	1
51427		REAL PROPERTY, DPW	TEMF		0	0	1	1
51428		REAL PROPERTY, DPW	TEMF		0	0	1	1
51432		REAL PROPERTY, DPW	TEMF		0	0	1	1
51450		AAFES	TEMF		0	0	2	2
51451		11 SC BDE HHC	TEMF	2	2	2	1	1
51452		REAL PROPERTY, DPW	GIB		0	0	1	1

Building Info				Containers				
Bldg.#	Bldg.# Ext.	Organization	Building Type	Exterior OCC	Exterior Paper	Exterior Other	Interior Paper	Interior Other
51453		REAL PROPERTY, DPW	TEMF		0	0	1	1
51456		REAL PROPERTY, DPW	TEMF		0	0	1	1
51457		REAL PROPERTY, DPW	TEMF		0	0	1	1
51458		REAL PROPERTY, DPW	TEMF		0	0	1	1
52008		CRAFT CENTER, FMWR	TEMF	1	1	1	2	2
52025		GAME STOP	PX	1	0	0	1	1
52030		MAIN EXCHANGE	PX	2	3	3	15	15
52038		SHOPPETTE / CLASS VI	PX	2	0	0	1	1
52045		Laundrette	PX	1	0	0	1	1
52048		PX FURNITURE / OUTDOOR LIVING	PX	2	0	0	3	3
52104		ARMY EDUCATION CENTER	GIB	1	2	2	6	6
52107		BDE HHC THEAT TAC SIG	DFAC	2	1	1	6	6
52204		Safety Office	Office-Small		0	0	1	1
52204		Union	Office-Small		0	0	1	1
52204		UPH HOUSING, DPW	Training Barracks	1	4	4	18	18
52204		REAL PROPERTY, DPW	Training Barracks		0	0	1	1
52308		REAL PROPERTY, DPW	BNHQ		1	1	4	4
52308		11 SC BDE HHC	GPW		1	1	2	2
52308		WTU	Training Barracks		1	1	6	6
52308		11 SC BDE HHC	UEPH		4	4	22	22
57439	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		0	0	2	2
57439	B	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	4	4
57439		DISA JOINT INTEROP TEST CMD SPT	TEMF		0	0	1	1
61730		W1E8AA CTR USA INT CEN & FT-04289	GIB		1	1	4	4
61730		W1E8AA CTR USA INT CEN & FT-04289	Office-Large	1	5	5	27	27
61730		Tradoc Culture Center	Office-Small		0	0	2	2
61801		WODA83 AMC/ASC LOGISTICS SUPPORT TEAM OVERHIRES	BNHQ		0	0	1	1
61801		DIS DISTRIBUTED LEARNING SYSTEM	GIB		0	0	2	2
61801		ACT USA SIGNAL NETWORK	GIB		0	0	2	2
61801		CTR USA CIV PERS OPS	GIB		0	0	1	1

Building Info				Containers				
Bldg.#	Bldg.# Ext.	Organization	Building Type	Exterior OCC	Exterior Paper	Exterior Other	Interior Paper	Interior Other
61801		CTR USA CIV PERS OPS	GIB		0	0	1	1
61801		Communications Security Logistics Activity (CSLA)	GIB		0	0	1	1
61801		CECOM	GIB		0	0	1	1
61801		NETCOM	GPW		1	1	4	4
61801		C-TNOSC	INFOSYS		3	3	14	14
61801		ACT USA SIGNAL NETWORK	INFOSYS		1	1	7	7
61801		CMD USA INFO SYS ENGR	INFOSYS		1	1	6	6
61801		DPTMS, USAG FT HUACHUCA	INFOSYS		0	0	2	2
61801		NETCOM	INFOSYS		0	0	1	1
61801		NETCOM	Office-Large	1	15	15	76	76
61801		Communications Security Logistics Activity (CSLA)	Office-Medium		3	3	17	17
61801		ACT USA SIGNAL NETWORK	Office-Medium		2	2	12	12
61801		CTR USA CIV PERS OPS	Office-Medium		2	2	11	11
61801		C-TNOSC	Office-Medium		2	2	11	11
61801		CMD USA INFO SYS ENGR	Office-Medium		1	1	7	7
61801		ACC	Office-Medium		1	1	6	6
61801		CECOM	Office-Medium		1	1	5	5
61801		ISEC	Office-Medium		1	1	5	5
61801		ACCAPG	Office-Small		1	1	3	3
61801		WGUX RCERT 1 (CONUS)	Office-Small		1	1	3	3
61801		REAL PROPERTY, DPW	Office-Small		1	1	3	3
61801		CTR USA INT CEN & FT	Office-Small		0	0	1	1
61801		OPM INVESTIGATIVE SVC	Office-Small		0	0	1	1
61801		CCIU TEAM C	Office-Small		0	0	1	1
61801		C-TNOSC	OHC		1	1	3	3
61801		AAFES	PX	2	1	1	2	2
61801		NETCOM	Religious		1	1	4	4
61801		SJA USAISC	Religious		0	0	1	1
61809		CO B 305 MI BN	GIB	1	11	11	55	55
61820		305 MI BN	GIB		4	4	20	20

Building Info				Containers				
Bldg.#	Bldg.# Ext.	Organization	Building Type	Exterior OCC	Exterior Paper	Exterior Other	Interior Paper	Interior Other
62702		CO C 304 MI BN	GIB	1	3	3	16	16
62703		CO B 305 MI BN	GIB		1	1	3	3
62703		CO A 305 MI BN	GIB		0	0	2	2
62703		CTR USA INT CEN & FT	GIB		0	0	1	1
62704		CTR USA INT CEN & FT	GIB	1	2	2	8	8
62712		CISAC	GIB		2	2	9	9
62715		CO A 309 MI BN	GIB		1	1	3	3
62718		NCO ACADEMY	Training Barracks		6	6	31	31
62722		NCO ACADEMY	GIB	1	3	3	13	13
63845		CTR USA INT CEN & FT	GIB	1	5	5	27	27
63845		CTR USA INT CEN & FT	INFOSYS		0	0	1	1
63902		CO A 305 MI BN	GIB	2	5	5	23	23
63902		304TH MI BN	GIB		3	3	16	16
63902		NCO ACADEMY	GIB		3	3	13	13
63902		CO E, HUMINT CMTE, CI DIVISION	GIB		0	0	1	1
63902		USAICS COE	Office-Large		3	3	17	17
70525		THUNDER MOUNTAIN ACTIVITY CENTER	DFAC	2	2	2	12	12
72805		BN EXPEDITIONARY SIG	TEMF	1	1	1	5	5
75801		40 SC BN	TEMF	1	1	1	2	2
75805		40 SC BN	TEMF		0	0	2	2
75901		DOL FT HUACHUCA AZ	TEMF		0	0	3	3
75902		DOL FT HUACHUCA AZ	TEMF	1	1	1	2	2
75903		DOL FT HUACHUCA AZ	TEMF		0	0	2	2
80011		CMD GLOBAL NETWORK EN	GIB		0	0	1	1
80011		CO D 306 MI BN	INFOSYS	1	1	1	4	4
80022	A	CO E, HUMINT CMTE, CI DIVISION	GIB		2	2	10	10
80023	A	CO E, HUMINT CMTE, CI DIVISION	GIB		1	1	3	3
80122		CO D 306 MI BN	GIB	2	5	5	25	25
80405		DPW, USAG FT HUACHUCA	Office-Small		0	0	1	1
80405		CO A 213th	Training Barracks	1	3	3	14	14
80405		Marines Detachment	Training Barracks		2	2	8	8
80406		CO D 305 MI BN	Training Barracks	1	4	4	18	18

Building Info				Containers				
Bldg.#	Bldg.# Ext.	Organization	Building Type	Exterior OCC	Exterior Paper	Exterior Other	Interior Paper	Interior Other
80406		UPB Branch	Training Barracks		1	1	5	5
80501		MILITARY CLOTHING STORE	PX	2	0	0	2	2
80503		REAL PROPERTY, DPW	DFAC	2	1	1	6	6
80504		REAL PROPERTY, DPW	DFAC	2	1	1	6	6
80505		CO A 304 MI BN	GIB		6	6	28	28
80505		CO B 304 MI BN	GIB		2	2	5	5
81305		CO B 305 MI BN	Training Barracks	1	3	3	17	17
81305		CO A 305 MI BN	Training Barracks		2	2	9	9
81405		CO B 305 MI BN	Training Barracks	1	2	2	9	9
81405		316 TRNG SQD, USAF	Training Barracks		1	1	6	6
82502		MAINT FMX FHFO	TEMF	1	1	1	5	5
84402		CO B 309 MI BN	Training Barracks	1	8	8	39	39
85202		AIT Complex	DFAC	2	3	3	13	13
86302		CO A 309 MI BN	Training Barracks	1	8	8	39	39
86332		CO F 309 MI BN	Training Barracks	1	8	8	39	39
91110		CO E 305 MI BN	TEMF		1	1	7	7
91110		AIR TRAFFIC CONTROL	TEMF		0	0	1	1
91114		2-13 AVN REGT	TEMF		1	1	6	6
91114		160 SC BDE DUIC	TEMF		0	0	1	1
91122		2-13 AVN REGT	GIB	1	3	3	14	14
91253		FIRE STATION #3	TEMF		0	0	1	1

Scenario #2 ROI calculation

The groupings of spreadsheets in Table A5 represent the ROI and supporting calculations for Scenario #2.

Table A5. ROI for Scenario #2 (ERDC-CERL).

PAYBACK PERIOD=	5.16 years
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	\$ Current Practice	\$ New option	Net Annual savings
One time cost		\$259,646	
Annual cost	N/A	\$(50,326)	\$50,326

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
One-time costs for new option				
Capital purchase, recycling containers at 92 selected buildings		\$157,186		
Labor to set out containers (1 month)		\$9,600		
Connection to utilities, site		N/A		
Staff time for coordination, contracting, etc. (one month)		\$14,400		
Outreach to installation, materials		\$20,000		
labels for bins @ \$20 ea.		\$58,460		
Annualized costs				
<i>Labor</i>				
DPW Staff labor (two months)	N/A	\$28,800	\$28,800	N/A
O&M Labor, Gov't	N/A	N/A	N/A	N/A
Service calls	N/A	N/A	N/A	N/A
Contractor labor	N/A	N/A	N/A	N/A
Periodic training, outreach (80 hours)	N/A	\$7,200	\$7,200	N/A
<i>Parts</i>				
Consumables	N/A	N/A	N/A	N/A
Parts	N/A	N/A	N/A	N/A
<i>Utilities</i>				
Electricity	N/A	N/A	N/A	N/A
Natural gas	N/A	N/A	N/A	N/A
Potable water	N/A	N/A	N/A	N/A
Sanitary sewer	N/A	N/A	N/A	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
Liquid fuels	N/A	N/A	N/A	N/A
<i>Waste</i>				
Avoided tipping fees (1109 tons @ \$35/ton) * 70% recovery rate	N/A	\$(27,171)	N/A	\$27,171
Additional cost for hauling recyclables (1464 tons @ \$90.42/ton) * 70% recovery rate	N/A	\$70,193	\$70,193	N/A
Hazardous waste handling and disposal	N/A	\$-	N/A	N/A
<i>Environmental Compliance</i>				
Staff time for permitting	N/A	N/A	N/A	N/A
Fees	N/A	N/A	N/A	N/A
<i>Vehicle Usage (cost to gov't)</i>				
Fuel cost	N/A	N/A	N/A	N/A
Security	N/A	N/A	N/A	N/A
Pavement maintenance	N/A	N/A	N/A	N/A
<i>Other</i>				
Market value of recyclables (70% recovery)	N/A	\$(129,349)	N/A	\$129,349
Misc. 2	N/A	N/A	N/A	N/A
Misc. 3	N/A	N/A	N/A	N/A
Misc. 4	N/A	N/A	N/A	N/A
Misc. 5	N/A	N/A	N/A	N/A
TOTAL Project Implementation cost		\$259,646		
Total Annual cost & savings	N/A	\$(50,326)	\$106,193	\$156,519

Scenario #3 building list

Table A6 lists the buildings considered in Scenario #3 and the number of containers (interior and exterior) needed per building by type of recyclable material. Note that some building numbers appear on multiple rows. That's because it's a large building with multiple functions.

Table A6. Scenario #3 building list and number of recycling containers needed per building (ERDC-CERL, with building details supplied by Fort Huachuca DPW).

Building Info				Number of Containers				
Building #	Bldg. # ext.	Organization	Building Type	Exterior OCC	Exterior paper	Exterior Other	Interior Paper	Interior Other
11640		2-13 AVN REGT	GIB	1	1	1	6	6
11640		2-13 AVN REGT	GIB	2	2	2	9	9
45001		RAYMOND W. BLISS CLINIC	Healthcare - Hospital	2	9	9	44	44
48101		CDC, FMWR	CDC	2	2	2	11	11
49055		CDC, FMWR	CDC	2	2	2	8	8
51005		HHC USAICoE	BNHQ		1	1	4	4
51005		902nd MI GP	COF		0	0	2	2
51005		CO E 2-13 Avn Regt	COF		0	0	1	1
51005		Learning Innovation	GIB		1	1	3	3
51005		ARNG	Office-Small		1	1	3	3
51005		ITRADS	Office-Small		0	0	2	2
51005		Judge Advocate Generals	Office-Small		0	0	1	1
51005		W3ZU USA DENTAL ACT	OHC		0	0	1	1
51005		111TH MI BDE	Training Barracks	1	9	9	45	45
51005		CO E 2-13 Avn Regt	Training Barracks		5	5	27	27
52030		MAIN EXCHANGE	PX	2	3	3	15	15
52056		CYS SERVICES, FMWR	CDC	2	2	2	12	12
52107		BDE HHC THEAT TAC SIG	DFAC	2	1	1	6	6
53301		TECHNOLOGY INTERGRATION CENTER	INFOSYS	1	4	4	19	19
53302		TECHNOLOGY INTERGRATION CENTER	INFOSYS		4	4	19	19

Building Info				Number of Containers				
Building #	Bldg. # ext.	Organization	Building Type	Exterior OCC	Exterior paper	Exterior Other	Interior Paper	Interior Other
57305	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	5	5
57305		DISA JOINT INTEROP TEST CMD SPT	INFOSYS	1	8	8	41	41
57428	A	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	B	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	C	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	D	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	E	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	3	3
57428	F	DISA JOINT INTEROP TEST CMD SPT	INFOSYS		1	1	4	4
57428		DISA JOINT INTEROP TEST CMD SPT	INFOSYS	1	2	2	8	8
61801		WODA83 AMC/ASC LOGISTICS SUPPORT TEAM OVERHIRES	BNHQ		0	0	1	1
61801		DIS DISTRIBUTED LEARNING SYSTEM	GIB		0	0	2	2
61801		ACT USA SIGNAL NETWORK	GIB		0	0	2	2
61801		CTR USA CIV PERS OPS	GIB		0	0	1	1

Building Info				Number of Containers				
Building #	Bldg. # ext.	Organization	Building Type	Exterior OCC	Exterior paper	Exterior Other	Interior Paper	Interior Other
61801		CTR USA CIV PERS OPS	GIB		0	0	1	1
61801		Communications Security Logistics Activity (CSLA)	GIB		0	0	1	1
61801		CECOM	GIB		0	0	1	1
61801		NETCOM	GPW		1	1	4	4
61801		C-TNOSC	INFOSYS		3	3	14	14
61801		ACT USA SIGNAL NETWORK	INFOSYS		1	1	7	7
61801		CMD USA INFO SYS ENGR	INFOSYS		1	1	6	6
61801		DPTMS, USAG FT HUACHUCA	INFOSYS		0	0	2	2
61801		NETCOM	INFOSYS		0	0	1	1
61801		NETCOM	Office-Large	1	15	15	76	76
61801		Communications Security Logistics Activity (CSLA)	Office-Medium		3	3	17	17
61801		ACT USA SIGNAL NETWORK	Office-Medium		2	2	12	12
61801		CTR USA CIV PERS OPS	Office-Medium		2	2	11	11
61801		C-TNOSC	Office-Medium		2	2	11	11
61801		CMD USA INFO SYS ENGR	Office-Medium		1	1	7	7
61801		ACC	Office-Medium		1	1	6	6
61801		CECOM	Office-Medium		1	1	5	5
61801		ISEC	Office-Medium		1	1	5	5
61801		ACCAPG	Office-Small		1	1	3	3
61801		W6UX RCERT 1 (CONUS)	Office-Small		1	1	3	3

Building Info				Number of Containers				
Building #	Bldg. # ext.	Organization	Building Type	Exterior OCC	Exterior paper	Exterior Other	Interior Paper	Interior Other
61801		REAL PROPERTY, DPW	Office-Small		1	1	3	3
61801		CTR USA INT CEN & FT	Office-Small		0	0	1	1
61801		OPM INVESTIGATIVE SVC	Office-Small		0	0	1	1
61801		CCIU TEAM C	Office-Small		0	0	1	1
61801		C-TNOSC	OHC		1	1	3	3
61801		AAFES	PX	2	1	1	2	2
61801		NETCOM	Religious		1	1	4	4
61801		SJA USAISC	Religious		0	0	1	1
61809		CO B 305 MI BN	GIB	1	11	11	55	55
61820		305 MI BN	GIB		4	4	20	20
63845		CTR USA INT CEN & FT	GIB	1	5	5	27	27
63845		CTR USA INT CEN & FT	INFOSYS		0	0	1	1
63902		CO A 305 MI BN	GIB	2	5	5	23	23
63902		304TH MI BN	GIB		3	3	16	16
63902		NCO ACADEMY	GIB		3	3	13	13
63902		CO E, HUMINT CMTE, CI DIVISION	GIB		0	0	1	1
63902		USAICS COE	Office-Large		3	3	17	17
70525		THUNDER MOUNTAIN ACTIVITY CENTER	DFAC	2	2	2	12	12
80122		CO D 306 MI BN	GIB	2	5	5	25	25
80503		REAL PROPERTY, DPW	DFAC	2	1	1	6	6
80504		REAL PROPERTY, DPW	DFAC	2	1	1	6	6
80505		CO A 304 MI BN	GIB		6	6	28	28
80505		CO B 304 MI BN	GIB		2	2	5	5

Building Info				Number of Containers				
Building #	Bldg. # ext.	Organization	Building Type	Exterior OCC	Exterior paper	Exterior Other	Interior Paper	Interior Other
85202		AIT Complex	DFAC	2	3	3	13	13
91122		2-13 AVN REGT	GIB	1	3	3	14	14

Scenario #3 ROI calculation

The groupings of spreadsheets in Table A7 represent the ROI and supporting calculations for Scenario #3.

Table A7. ROI for Scenario #3 (ERDC-CERL).

PAYBACK PERIOD	4.25 years
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	\$ Current Practice	\$ New option	Net Annual savings
One time cost		\$174,465	
Annual cost	N/A	\$(41,077)	\$41,077

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
One-time costs for new option				
Capital purchase, recycling containers, at 25 selected buildings		\$95,885		
Labor to set out containers (2 weeks)		\$4,800		
Connection to utilities, site		N/A		
Staff time for coordination, contracting, etc. (one month)		\$14,400		
Outreach to installation, materials		\$20,000		
labels for bins @ \$20 ea.		\$39,380		
Annualized costs				
Labor				
DPW Staff labor (one month)	N/A	\$14,400	\$14,400	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
O&M Labor, Gov't	N/A	N/A	N/A	N/A
Service calls	N/A	N/A	N/A	N/A
Contractor labor	N/A	N/A	N/A	N/A
Periodic training, outreach (80 hours)	N/A	\$7,200	\$7,200	N/A
<i>Parts</i>				
Consumables	N/A	N/A	N/A	N/A
Parts	N/A	N/A	N/A	N/A
<i>Utilities</i>				
Electricity	N/A	N/A	N/A	N/A
Natural gas	N/A	N/A	N/A	N/A
Potable water	N/A	N/A	N/A	N/A
Sanitary sewer	N/A	N/A	N/A	N/A
Liquid fuels	N/A	N/A	N/A	N/A
<i>Waste</i>				
Avoided tipping fees (1843 tons @ \$35/ton) * 70% recovery rate	N/A	\$(20,654)	N/A	\$20,654
Additional cost for hauling recyclables (843 tons @ \$90.42/ton) * 70% recovery rate	N/A	\$53,357	\$53,357	N/A
Hazardous waste handling and disposal	N/A	N/A	N/A	N/A
<i>Environmental Compliance</i>				
Staff time for permitting	N/A	N/A	N/A	N/A
Fees	N/A	N/A	N/A	N/A
<i>Vehicle Usage (cost to gov't)</i>				
Fuel cost	N/A	N/A	N/A	N/A
Security	N/A	N/A	N/A	N/A
Pavement maintenance	N/A	N/A	N/A	N/A
<i>Other</i>				
Market value of recyclables (70% recovery)	N/A	\$(95,381)	N/A	\$95,381
Misc. 2	N/A	N/A	N/A	\$-
Misc. 3	N/A	N/A	N/A	N/A
Misc. 4	N/A	N/A	N/A	N/A
Misc. 5	N/A	N/A	N/A	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
TOTAL Project Implementation cost		\$174,465		
Total Annual costs & savings	\$-	\$(41,077)	\$74,957	\$116,034

ROI for brass direct sales

The groupings of spreadsheets in Table A8 represent the ROI and supporting calculations for direct sales of brass.

Table A8. ROI brass direct sales (ERDC-CERL).

PAYBACK PERIOD=	(never) years
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	\$ Current Practice	\$ New option	Net Annual savings
One time cost		\$275,747	
Annual cost	N/A	\$5,811	(\$5,811)

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
One-time costs for new option				
Capital purchase, safety certification unit		\$146,054		
Labor to install (40 hr)		\$2,400		
Connection to utilities, site		\$10,000		
Staff time for coordination, contracting, etc. (three weeks)		\$9,600		
Training and travel (four people, two weeks TDY)		\$34,400		
Purchase brass deformer		\$73,293		
Annualized costs				
<i>Labor</i>				
DPW Staff labor (2 weeks)	N/A	\$6,400	\$6,400	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
O&M Labor, Gov't (two people, 2 weeks per year)	N/A	\$9,600	\$9,600	N/A
Service calls	N/A	N/A	N/A	N/A
Contractor labor	N/A	N/A	N/A	N/A
Periodic training (one week training per year, two people)	N/A	\$4,800	\$4,800	N/A
<i>Parts</i>				
Consumables	N/A	N/A	N/A	N/A
Parts	N/A	\$5,000	\$5,000	N/A
<i>Utilities</i>				
Electricity for deformer	N/A	\$164	\$164	N/A
Propane for Safety Certifier	N/A	\$1,320	\$1,320	N/A
Potable water	N/A	N/A	N/A	N/A
Sanitary sewer	N/A	N/A	N/A	N/A
Liquid fuels	N/A	N/A	N/A	N/A
<i>Waste</i>				
Solid waste management and disposal	N/A	N/A	N/A	N/A
Universal waste handling and disposal	N/A	N/A	N/A	N/A
Hazardous waste handling and disposal	N/A	N/A	N/A	N/A
<i>Environmental Compliance</i>				
Staff time for permitting	N/A	N/A	N/A	N/A
Fees	N/A	N/A	N/A	N/A
<i>Vehicle Use (cost to gov't)</i>				
Fuel cost	N/A	N/A	N/A	N/A
Security	N/A	N/A	N/A	N/A
Pavement maintenance	N/A	N/A	N/A	N/A
<i>Other</i>				
Income from Brass sales 12,000 pounds/yr., \$1.75/pound)	N/A	\$(21,473)	N/A	\$21,473
misc. 2	N/A	N/A	N/A	N/A
Misc. 3	N/A	N/A	N/A	N/A

Item	\$ Current Practice	\$ Proposed Project	\$ Net Annual Project Cost, by Line Item	\$ Net Annual Project Savings, by Line Item
Misc. 4	N/A	N/A	N/A	N/A
Misc. 5	N/A	N/A	N/A	N/A
TOTAL Project Implementation Cost		\$275,747		
Total Annual Cost & Savings	\$-	\$5,811	\$27,284	\$21,473

Figure A1. Safety certification machine (GSA Advantage).

Enlarge/More Views >>

\$146,054.00 EA
sold and shipped by
BOULDIN CORPORATION
visit contractor's website

SAFETY CERTIFICATION UNIT

Mfr Part No.: 18860
Contractor Part No.: 18860
Manufacturer: BOULDIN & LAWSON LLC
Contract No.: GS-07F-5703P (ends: Aug 14, 2021)
MAS Schedule/SIN: 084/426 4E
Warranty: 90 DA
Made In: UNITED STATES OF AMERICA
Weight: 8000.000 LB
Order Increment: 1

DISAST PURCH Disaster Purchasing items
COOP PURCH Cooperative Purchasing items

Desc

29L X 8W (EX),
MOBILE SAFETY CERTIFICATION UNIT for SMALL ARMS BRASS Thermally Process Spent Brass Cartridges Up To And Including 50 Caliber At 1,000 - 2,000 Lbs. Per Hour Depending On Size and Mix of Cartridges Includes:"Trailer Mounted - Dual Axles, Marker Lights, Turn Signals and Brake Lights, Electric Brakes With Electric Breakaway Safety System "In-Feed Conveyor - Includes Hopper For Loading , Electric Motor Drive, 110V/Single Phase "Discharge Conveyor - Electric Motor Drive, 110V/Single Phase" PropaneBurner - Electric, 110V / Single Phase, With Stainless Steel Hood" Heat Chamber - With Thermo Insulating Blanket To Prevent Heat Loss"Propane Genset - Electric Start, Providing Electrical Power for Conveyors, Propane Burner and Controls

Compare Available Sources

Quantity: **Add to Cart**

Instructions: Select price below, enter qty at left, then Add to Cart. To view another contractor description, simply select the Contractor in the list below.
Indicates when volume discounts are offered.

Price/Unit	Contractor	Socio	Photo	Deliv Days	Min	FOB/Shipping
\$146,054.00 EA	BOULDIN CORPORATION	s		120 days delivered ARO	\$100.00	O-CONUS,AK,PR,HI

Figure A2. Brass deformer (GSA Advantage).

Enlarge/More Views >>

\$73,293.00 EA
sold and shipped by
BOULDIN CORPORATION
visit contractor's website

STATIONARY ORDNANCE DEFORMER

Mfr Part No.: 18850
Contractor Part No.: 18850
Manufacturer: BOULDIN & LAWSON LLC
Contract No.: GS-07F-5703P (ends: Aug 14, 2021)
MAS Schedule/SIN: 084/426 4E
Warranty: 90 DA
Made In: UNITED STATES OF AMERICA
Weight: 5000.000 LB
Order Increment: 1

DISAST PURCH Disaster Purchasing items
COOP PURCH Cooperative Purchasing items

Desc

26L X 6W (EX), Stationary Ordnance Deformer Processes Spent Cartridges Up To and Including 20MM at 8,000 to 11,000 LBS per hour depending on size and mix of cartridges. Includes: Infeed Conveyor, Electric Drive, Infeed Catch Hopper, High Speed Rotary Drum Grinder, 480V/Three Phase, Includes Hood, Chute & Soft Start. Discharge Conveyor, Electric Drive, Control Panel & System Integration.

Compare Available Sources

Quantity: **Add to Cart**

Instructions: Select price below, enter qty at left, then Add to Cart. To view another contractor description, simply select the Contractor in the list below.
 ♦ Indicates when volume discounts are offered.

Price/Unit	Contractor	Socio	Photo	Deliv Days	Min	FOB/Shipping
☐ \$73,293.00 EA	BOULDIN CORPORATION	s		120 days delivered ARO	\$100.00	O-CONUS,AK,PR,HI

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14. ABSTRACT This document details the processes and procedures that Fort Huachuca, Arizona, must follow to establish a qualified recycling program (QRP). QRP programs help installations meet Army goals to minimize waste disposal costs and increase waste diversion rates. This document will outline three optimizing recycling collection strategies: (1) collection from all buildings, (2) collection by building type, and (3) collection only from specific buildings. In an effort to help Fort Huachuca determine the feasibility of establishing a recycling and QRP program, these scenarios are formulated according to three main recycling and QRP program goals: income, diversion, and a combination of both income and diversion. Each scenario is presented with an economic analysis. Wherever feasible, the QRP is an effective mechanism, and it offers a cost-effective way to use funds from the sale of recyclables to support a recycling program and various morale, welfare, and recreation efforts.					
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