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Final Report

Mitigation of Hazardous Waste Contamination in Urban Areas: Supporting Inclusive Growth: 47144 001, Regional Capacity Development Technical Assistance (R-CDTA 8458)

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Project Location: Regional
Indonesia: Greater Jakarta, Bogor and Tegal Districts
Philippines: Metropolitan Manila Bay, Bulacan Province, Marilao, Meycauayan, and Obando Municipalities

Executing Agency: Asian Development Bank (ADB), Southeast Asia Department, Urban Development and Water Division, SERD

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Implementing Agencies
Indonesia: Ministry of Environment,
Office of Hazardous Waste, Hazardous Substance, and Solid Waste Management
Philippines: Foreign Assisted and Special Project Office (with support from Department of Environment and Natural Resources -Environmental Management Bureau)

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List of Abbreviations

DALY	Disability Adjusted Life Year
DENR	Department of Environment and Natural Resources, The Philippines
GEF	Global Environment Facility
GIS	Geographic Information System (Mapping)
IEC	Information, Education and Communication
ILMC	International Lead Management Center
ISS	Initial Site Screening
JICA	Japanese International Cooperation Agency
KPBB	Indonesian Lead Information Centre
MOEF	Ministry of Environment and Forestry, Government of Indonesia
NIOEH	The National Institute of Occupational and Environmental Health
NGO	Non-governmental organization
NPL	National Priorities List
Pb	Lead
PMT	Project Management Team
SMEs	Small and Medium scale Enterprises
TA	Technical Assistance
TSIP	Toxic Sites Identification Program
ULAB	Used Lead Acid Battery

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CHAPTER ONE

Executive Summary

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INTRODUCTION AND REPORT STRUCTURE

1. The Asian Development Bank (ADB) with financial support from the Japan International Cooperation Agency (JICA) contracted Blacksmith Institute (NY, NY, USA) as Consultant for this capacity development technical assistance (TA). The purpose of the TA was to mitigate potential public health risks from hazardous waste generated by small and medium scale enterprises (SMEs) in urban communities in Indonesia and the Philippines. The project was executed over a 24-month period from August 2014 to August 2016.
2. The project performed well across all key indicators. Project outputs were produced as contracted and to the approval of stakeholders. Overall expenditures were below budgeted amounts.
3. The most significant result of this effort is the likely remediation and redevelopment of one the of project sites, Pesarean Village. The work conducted as part of this effort facilitated the engagement of a donor and relevant government agencies in executing

the proposed project. As part of that follow on work, the site is currently in the early stages of remediation planning.

4. This report is structured around six chapters. To facilitate application of key lessons outside of the project context, each chapter is intended to be capable of standing alone. The Executive Summary (Chapter 1) provides basic project background and performance across key indicators. The Executive Summary also provides an overview of each chapter. Chapter 2 (Hazardous Waste Management and Urban Revitalization) is a brief primer on the theme. It is intended for policy makers and practitioners to garner a basic understanding of relevant concepts. Chapters 3 and 4 (Strategic Urban Redevelopment Planning) provide detailed descriptions of the pilot sites chosen under the project. Justification for selection, activities carried out, and a summary of key site characteristics including the results of sampling and analysis, are provided here. Chapters 5 (Guidebook on Pollution Control and Remediation for SMEs) and 6 (Guidebook on Redevelopment Planning and Financing) are intended to be instructional summaries based on the lessons learned during the project. These documents could be used outside of this project to provide a basis for work in remediation and redevelopment planning.

Outcomes and Outputs

5. The key outcome of the TA was improved environmental management and community development capacity in the selected pilot areas. Three major outputs contributed to this outcome and are summarized below.
   5.1. Output 1: Capacity Assessment and Awareness Creation
   5.2. The purpose of this output was to assess baseline knowledge and increase awareness among government, communities, and industries in the pilot locations of the potential impact of toxic pollution and the need to protect available land and water resources.
   5.3. Output 2: Strategy and Action Plan Formulation
   5.4. The purpose of this output was to formulate strategic urban redevelopment plans. Prefeasibility studies on hazardous industrial waste management alternatives were conducted jointly with local stakeholders.

5.5. Output 3: Community Development and Institutional Strengthening

5.6. The purpose of this output was to strengthen the capacity of government and other stakeholders to integrate environmental management and urban development through training programs, development of toolkits, and piloting of alternative livelihood programs.

Deliverables

6. A number of deliverables were produced during the project that directly contributed to the completion of outputs. Key deliverables are summarized below, organized by output.

6.1. Output 1

6.1.1. Capacity and Needs Assessment

6.1.2. For each of the three main stakeholder groups (community, industry, and regulatory) a Capacity and Needs Assessment Analysis was conducted. The analysis reviewed problems faced related to hazardous waste management, and gaps in awareness to be addressed in the Information, Education, and Communications (IEC) campaigns. The capacity and needs assessment formed the base of the IEC campaigns and is included in the IEC report in Appendix A.

6.1.3. Information Education and Communication (IEC) Campaigns

6.1.4. The team worked closely with government agencies and multi-stakeholder groups in Indonesia and the Philippines to produce IEC campaigns that developed common messaging to build knowledge and prevent unsafe exposures, created print and video materials to reinforce lessons, and designed training workshops with both classroom and hands-on components.

6.1.5. The IEC campaigns included capacity building modules on identifying informal hazardous waste sites, recognizing impacts of hazardous waste on human health and the environment, and regulating formal and informal enterprises. This involved classroom and field-based trainings on assessing contaminated sites; determining regulatory compliance of smelting operations, tanneries, and gold shops; reviewing best practices in hazardous waste management; and recognizing health effects of exposure to hazardous waste. All IEC materials are included in Appendix A.

6.2. Output 2

6.2.1. Policy Dialogues on Industrial Pollution Mitigation

6.2.1.1. Policy dialogues were held formally and informally through focus group discussions, multi-stakeholder group meetings, and in workshop sessions. Current policy gaps were assessed in relation to urban redevelopment and hazardous waste management needs and recommendations were made by the project team and the multi-stakeholder working group. These gaps were then addressed by local and national government action or included in the final action plan of each pilot site and jointly discussed with government and industry actors responsible for implementation. The results of the policy dialogues - government responses and recommended policy guidelines - are included in Appendix B.

6.2.2. Strategic Urban Redevelopment Plans

6.2.2.1. The TA engaged development, remediation, and financing professionals to prepare strategic urban redevelopment concepts for each pilot site. These concepts were then approved by the community stakeholder groups and finalized into redevelopment plans that can be offered to developers or investors in each country. Each plan includes potential redevelopment opportunities, initial investment costs of purchase, remediation, and development and potential revenues from sales and commercial or institutional rentals along with financing opportunities and pubic-private partnership recommendations. The plans for the pilot sites are included in Chapters 3 and 4.

6.2.3. Pre-feasibility Studies on hazardous waste pollution mitigation for micro, small and medium enterprises

6.2.3.1. The prefeasibility studies conducted under the TA reviewed viable options for hazardous waste pollution mitigation, particularly for small-scale operators. Used Lead Acid Battery recycling, tanneries, and gold smelting were key enterprises addressed given that these are major small-scale industries in both countries. The studies led to capacity building sessions on best practices in pollution control, hazardous waste management, and industry compliance and field trips to industries utilizing environmentally-responsible pollution control methods. Finally, industry monitoring and reporting processes were reviewed and discussed with government regulators and both countries took steps toward online registration and data management systems for industry and hazardous waste management which are expected to improve oversight and support programs. The Prefeasibility Studies are included in Appendix C.

6.3. Output 3

6.3.1. Poverty, Economic, and Health Assessment

6.3.1.1. The Poverty, Economic, and Health Assessments determined the immediate health risks of populations in the pilot site areas, economic and socio-economic factors affecting the residents, and any livelihoods that would be impacted by a redevelopment and remediation project. The reports are included in Appendix D and formed a key part of the Strategic Urban Redevelopment Plans.

6.3.2. Alternative Livelihood Training

6.3.2.1. Alternative Livelihood trainings were held in The Philippines on February 21-21, 2016. The discussions led to recommendations regarding how to ensure safe livelihoods (best practices in personal protective equipment and workplace safety) as well as capacity building and financial needs for alternative livelihoods. In the Philippines a local partner organization, Kabalikat sa Maunlad na Buhay. was identified that will

continue working with the residents who expressed interest in alternative livelihoods trainings. In Indonesia, the redevelopment plans included alternative livelihoods vendors in the design of new rental spaces for handicraft stores and food stalls and made recommendations for national support of alternative livelihoods through the Ministry of Industry. Details on the outcomes of the Alternative Livelihood Meetings are included in Appendix E.

6.3.3. Capacity-building Program on Environmental Management involving Hazardous Waste Mitigation

6.3.3.1. The capacity building program for local and national government, community, and industry was part of each of the multi-stakeholder group meetings, covering industry compliance, environmental and health impacts of hazardous waste, and hands-on demonstrations of monitoring equipment. Additionally, specific community development and action plans were developed for each pilot site and included as part of the Strategic Urban Redevelopment Plans. The Capacity building program materials are included in Appendix A and the Action Plans are included in Chapters 3 and 4.

6.3.4. Guidebook on Industrial Pollution Mitigation for Micro, Small and Medium Enterprises

6.3.4.1. The Guidebook on Industrial Pollution Mitigation forms Chapter 5. The guidebook is meant to support local government in designing monitoring programs and providing a summary document on the types of pollution mitigation that can be considered for various industries.

6.4. Additional Deliverables

6.4.1. In addition to those deliverables directly tied to the production of project outputs, a number of milestones were met during the project that are worth

listing here. These include deliverables related project management and administration as well as those contributing a number of outputs.

6.4.2. Inception Report

6.4.2.1. An Inception Report was submitted and accepted in September 2014. The Inception Report provided the overall project structure including a summary of key outcomes, outputs and deliverables, a staffing and project management overview, and a detailed work plan for project execution.

6.4.3. Pilot Sites Chosen

6.4.3.1. Two pilot sites were selected in 2nd quarter of 2015. An initial list of 30 contaminated sites was developed and rapidly assessed. These assessments were reviewed by project partners and prioritized for detailed assessment. Of these four sites in Indonesia and five in the Philippines were visited and assessed in detail by the project team. Sites were reviewed across a range of parameters including the extent and severity of contamination and redevelopment feasibility. Detailed results of this process are provided Chapters 3 and 4 of this report.

6.4.4. Baseline Profiles

6.4.4.1. Baseline Profiles were produced for each pilot site, reviewing the history, land use, local economy, local demographics, known contaminants, political and environmental issues, and other strengths and weaknesses including the potential for successful redevelopment. The Baseline Profiles can be found in Appendix F.

6.4.5. Mid-Term Report

6.4.5.1. The Mid-Term report was submitted in May 2015, detailing the inception workshops held in early 2015, the selection process for the Strategic Urban Redevelopment Planning pilot site in each country, and the baseline data collection at each site included contamination investigations,

poverty and economic analyses, and relevant environmental regulations in each area.

6.4.6. Interim Project Report

6.4.6.1. An interim project report was submitted in April 2016. The report summarized progress along each output. The most significant update in the Interim report was the presentation of the Information, Education, and Communication Materials and Trainings that were developed with and for key stakeholders of the TA.

Chapter Summaries

6.5. The report is comprised of six individual chapters. Each chapter is intended to contribute to an understanding of the overall project but is also capable of standing alone as its own work product. The purpose here is to facilitate the use of the lessons learned outside of the project context. A summary of each chapter is provided below.

6.5.1. Chapter 2: Capacity Assessment and Awareness Creation

6.5.1.1. Chapter 2 addresses key roadblocks in low and middle-income countries related to hazardous waste management and the related Information, Education, and Communication campaigns developed under the TA for government, community, and industry stakeholders. Key topics include: Identification of Contaminated Sites, Best Practices in Hazardous Waste Management, and Public Health Education

6.5.2. Chapter 3: Strategic Urban Redevelopment Plan, The Philippines

6.5.2.1. Chapter 3 highlights a pilot site in the Philippines that is an abandoned, former used lead acid battery recycling plant that is in need of remediation and has the potential to be redeveloped into a profitable, productive local asset. The chapter reviews the site selection process that was undertaken in the Philippines, profiles the site and the surrounding community and the environmental and health risks, and proposes a

redevelopment solution for the site along with a detailed Action Plan for implementation of the recommendations.

6.5.3. Chapter 4: Strategic Urban Redevelopment Plan, Indonesia

6.5.3.1. Chapter 4 describes a pilot site in Indonesia that is a waste dump site in the center of a historic metal-working village. The chapter reviews the efforts of the local government in relocating dangerous activities out of the residential areas, highlights the potential for redevelopment at the site to include a tourism component building in the village history, and proposes a redevelopment plan for the site to follow the planned remediation activities already in planning stages.

6.5.4. Chapter 5: Guidebook on Pollution Control and Remediation for SMEs

6.5.4.1. Chapter 5 reviews best practices in pollution control, particularly for the most common SMEs in the target countries – Used lead acid battery recycling, gold smelting, and tanneries. The chapter also includes general guidelines for planning a remediation of a contaminated site. This chapter can be used by local governments or community groups that are interested in pollution prevention, pollution monitoring, and remediation planning.

6.5.5. Chapter 6: Guidebook on Redevelopment Planning for Contaminated Sites

6.5.5.1. Chapter 6 provides a general overview of the process of redevelopment for contaminated sites including commonly encountered challenges. The chapter can be used by local governments and community groups interested in redeveloping contaminated and under-utilized sites and contains useful checklists for undertaking a redevelopment project.

Challenges

7. The challenges encountered during the execution of the project mainly involved complications with site ownership. These types of challenges are not unusual when dealing with legacy, contaminated sites especially sites that have been auctioned off in bankruptcy as was the case with the Philippines site. Current owners of the land were

not always up-to-date in government records or were not aware that they were listed as owners of the site. In the case of the Indonesia site, there were multiple owners of small portions of the site including religious and historical institutions. While ownership issues can complicate redevelopment planning, they typically can be overcome in time. The team continued with the planning because the likelihood that the owners will cooperate is quite high given that their cooperation will increase the value of their land and that local government is in support of the redevelopment planning. Additionally, the purpose of the pilot sites and the Strategic Urban Redevelopment Plans was to develop a model project that could be used by government and community groups to spur development at other contaminated sites. The challenges encountered by the project will be learning opportunities for others interested in similar projects. All challenges are documented in the Strategic Urban Redevelopment Plans in Chapters 3 and 4.

Staffing and Costing

8. Staffing
   8.1. The TA team was well staffed with qualified experts in key roles. Overall staff completed their required tasks on time, within budget and to a high standard. Some initial staffing changes were required early in the project due to unavailability of initially proposed consultants.
9. Costing
   9.1. The project was completed for less than the approved budget of US $1,477,764. Final accounting is still in progress, but the submitted reimbursable expenses were in line with the allowable budget or were under-spent by approximately US$165,000 and approximately US$150,000 remains in the contingency fund. All financial reports will be submitted by November 30, 2016.

Conclusion

10. It is the desire of the TA project team that the work undertaken as part of this project be continued by the relevant government agencies. The contaminated sites identified under the TA make up only a small portion of the sites that exist in each country. Therefore, the number of people in each country being exposed to toxic levels of contaminants is

undercounted and underappreciated. If contaminated sites go unaddressed, the population is at risk, the environment is at risk, and the future productivity of the country is at risk. The good news is that it is possible to respond to this pollution. This series of chapters offers one response – the use of a brownfield redevelopment model to identify potentially valuable sites where private investors could be persuaded to undertake remediation in order to develop the site into a more valuable property and earn back the initial cleanup and investment costs in a reasonable amount of time. This TA developed instruction manuals to support local governments in enacting these types of programs in order to address the contaminated sites within the areas for which they hold responsibility. While the team recognizes that brownfield redevelopment is not always an option, they worked to document the steps required in finding appropriate sites, understanding remediation requirements, and developing high potential development opportunities to attract investors. These tools should be added to the government response toolkit in responding to environmental and health concerns in their respective countries.

11. This report was drafted in August 2016 at the end of the project, edited to include feedback from the Final Workshops, and delivered to ADB and the governments of The Philippines and Indonesia in November 2016. All materials referenced in the report can be found on the project website at: http://www.pureearth.org/project/urbandevelopment. Questions or comments regarding this project can be directed by email to Lara Crampe, Regional Director, Southeast Asia, Pure Earth New York, Lara@pureearth.org.

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Hazardous Waste Management and Urban Revitalization

An Overview

Chapter 2

Chapter 2

Hazardous Waste Management & Urban Revitalization: An Overview

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CHAPTER SUMMARY

1. This chapter is intended as a primer for policy makers and practitioners interested in the theme covered by this TA. It provides a general summary on some key outputs produced. It also highlights some of the more important lessons learned.

2. At the core of this project is the recognition that hazardous waste management in low and middle-income countries (LMICs) faces a particular set of challenges. While there are many examples of effective regulatory and enforcement regimes in higher income countries, these same solutions are not necessarily readily applicable in the context of LMICs.

3. This TA sought to identify the key roadblocks in LMICs regarding hazardous waste management, including gaps in knowledge, regulation and enforcement. The project engaged a diverse group of stakeholders—local governments, industry representatives,

small-scale or “backyard” enterprises, technical consultants, and community development specialists. Discussions with these working groups led to the guidance documents presented in this report and available on the project website - http://www.pureearth.org/project/urbandevelopment.

4. Hazardous waste is defined as a materials or byproducts that, owing to toxic, infectious, radioactive, or flammable properties, pose an actual or potential risk to the health of humans, other living organisms, or the environment.[1] These wastes may take the form of gases, liquids, or solids, and require a distinct set of processes governing management and disposal.

5. Hazardous waste is generated in all countries, but the related tracking, management, disposal, and exposures of the population vary greatly, particularly between high-income and low-income countries. Challenges in hazardous waste management are closely related to abandonment or underutilization of polluted land in urban areas. Former industrial sites from both cottage and formal industry are often underutilized.

6. These polluted sites require assessment and remediation in order to be redeveloped and useful. Site intervention and redevelopment is particularly important in urban areas with limited space and growing populations. Through workshops, primary research, and interviews, this TA identified and addressed key challenges in hazardous waste management and urban revitalization. Some of the major issues identified included:

    - Disjointed information on hazardous waste and locations of hazardous waste sites;
    - Incomplete training in assessment and mitigation;
    - Insufficient enforcement and gaps in regulation;
    - Lack of awareness regarding household and public health risks;
    - Uncooperative land owners;
    - Difficulty of financing for developers willing to remediate and redevelop sites;

[1] United Nations Environment Programme, Training Resource Pack for Hazardous Waste Management in Developing Economies, 2002

- Few options for alternative livelihoods for informal operators;
- Limited experience in remediation of contaminated sites;

7. This TA focused on capacity building for hazardous waste management and urban revitalization in the two target countries - Indonesia and the Philippines - for a variety of government and community stakeholders. The capacity building activities focused on strengthening hazardous waste identification and management practices, highlighting policy and enforcement gaps, identifying public health and household risks, and researching the potential for alternative livelihoods, remediation and urban redevelopment for each country. To demonstrate the potential of redevelopment and inclusive growth in polluted areas, the TA piloted work in one community of each target country. Pilot sites were identified as urban areas with formal and informal industrial zones wherein the improper handling and disposal of toxic byproducts or waste is causing hazardous contamination. Pure Earth collaborated with local communities, governments, and relevant industries to illustrate how the pilot sites could better support inclusive growth. This report summarizes the work of the TA and is supplemented by the many training guides and communication materials generated during the project, which are attached as Appendices and available on the project website. This chapter provides an overview of some of the key project outputs and is intended to act as a primer for policy makers and practitioners interested in this theme.

INFORMATION, EDUCATION, AND COMMUNICATION ACTIVITIES

> **Key Message**
> Mishandling hazardous waste can cause grave health exposures for local workers and communities and we must and can take

8. The project team collected baseline information in order to address the capacity building needs of the government, community, technical, and industry stakeholders. This work included workshops, interviews, surveys, research on current applicable regulations, review of local land use plans, and data on polluted sites already identified by the Pure Earth Toxic Sites Identification Project (TSIP). The team then developed an Information, Education and

Communication (IEC) strategy with specific educational targets for each involved stakeholder group. The general strategy is presented in Figure 1 and the detailed IEC plan is presented in Appendix A. The purpose of the IEC strategy was to address known gaps in the knowledge, attitudes, and practices of key stakeholders with the goal of mitigating impacts of hazardous waste contamination and implementation of the proposed Action Plans for redevelopment at each pilot site. The over-arching message was that *mishandling hazardous waste can cause grave health exposures for local workers and communities and we must and can take action now to ensure the health and wellbeing of ourselves, our families, and our community, now and in the future*. Communication materials can be found in Appendix A, including links to a video and general educational materials developed for workshops and training sessions.

Figure 1: IEC Strategy Approaches by Stakeholder

STAKEHOLDER	ISSUE TO ADDRESS	APPROACH
National government	Disjointed toxic sites data Regulation/enforcement gaps Financing opportunities Remediation opportunities	Stakeholder Meetings Hands-On Workshops Printed Materials
Local government	Disjointed toxic sites data Regulation/enforcement gaps Financing opportunities Remediation opportunities Training on assessment and mitigation	Stakeholder Meetings Hands-On Workshops Training Sessions Video Printed Materials
Industry	Unaware of health risks Unaware of best practices for compliant operations	Stakeholder Meetings Hands-On Workshops Training Sessions Field Visits Video Printed Materials
Informal industry	Unaware of health risks Unaware of best practices for compliant operation Alternative livelihood options	Stakeholder Meetings Hands-On Workshops Training Sessions Video Printed Materials
Households	Unaware of health risks and exposure pathways	Stakeholder Meetings One-on-One Discussions Video Printed Materials
Public Health Workers	Unaware of health risks, exposure signs, and typical exposure pathways	Stakeholder Meetings Hands-On Workshops Training Session Printed Materials

9. While all materials were developed and already presented in various stakeholder meetings and training sessions, they were not intended for use solely in this project. These materials are meant to be tested, revised, shared, and reused in ongoing training and informational sessions. As such, digital, editable versions of all printed materials are made available along with this report. These same materials will be accessible to government agencies and civil society leaders who will lead the efforts to better enforce hazardous waste regulations, to keep the population safe, and to support redevelopment and remediation efforts at abandoned and under-utilized polluted sites in their jurisdictions. Applicable training materials from the specific capacity building activities of the project are referenced in the subsections of this report that follow.

IDENTIFICATION OF CONTAMINATED SITES

10. A common issue in hazardous waste management in LMICs is the dearth of information regarding current and former contaminated sites. Few countries in this income grouping have active site identification and assessment program. Since 2008 Pure Earth has partnered with 49 countries to execute the Toxic Sites Identification Program (TSIP). The TSIP is an effort to identify and assess contaminated land. To date, the program has identified more than 3,100 toxic sites around the world, including 444 in Southeast Asia, 119 in Indonesia and 118 in The Philippines. The detailed data on these sites has been shared with the governments and relevant ministries. At the outset of this TA, the project team presented toxic sites data to stakeholders at the Inception Workshops on January 30, 2015 in The Philippines and February 3, 2015 in Indonesia and led discussions about contaminated sites, the most common contaminants in each country, and the risks to human health and the environment. The maps below show identified contaminated sites in Indonesia and The Philippines. The most common contaminants and sources that were identified at the sites are listed in Figure 2.

Figure 2: Identified Contaminated Sites - Indonesia

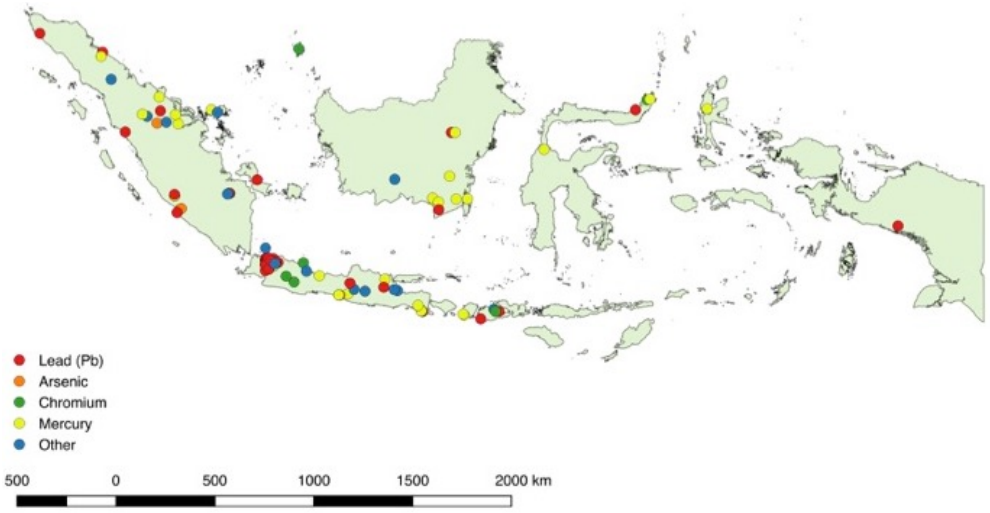


Figure 3: Identified Contaminated Sites - The Philippines

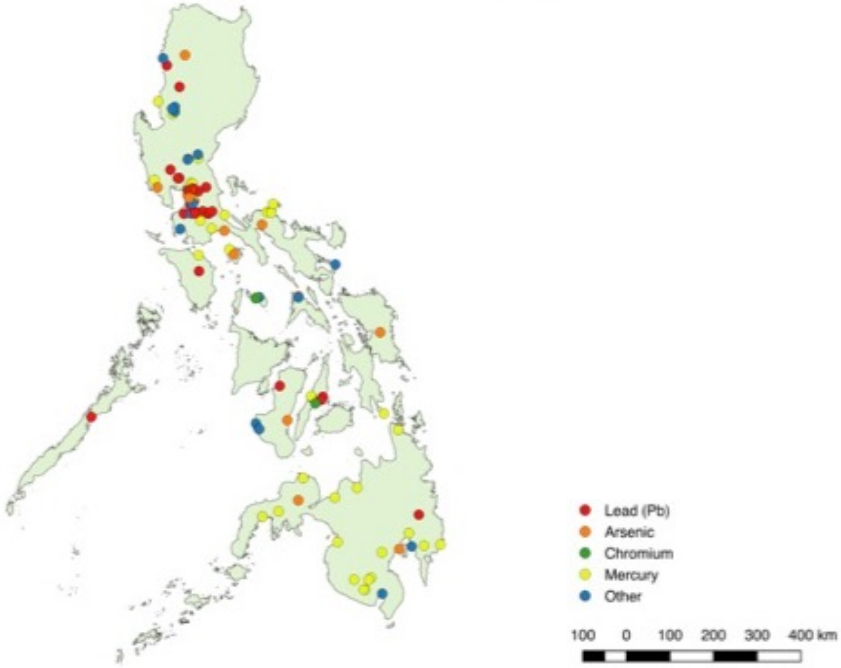


Figure 4: Most Common Contaminants and Sources

Country	Contaminant	Most Common Source
Philippines & Indonesia	Lead	Used Lead Acid Battery Recycling, Smelting
Philippines & Indonesia	Mercury	Small-scale gold mining
Philippines	Arsenic	Small-scale gold mining
Philippines	Cadmium	Small-scale gold mining
Indonesia	Chromium	Small-scale gold mining, Other Industry

11. The TA team also worked with local governments to determine how industries, particularly small-scale operators that may use hazardous materials are tracked at the local, regional, and national level. At the beginning of the project, it was assumed that there was limited knowledge of the industries using toxic. In the course of the workshops, it became evident that the governments in both countries do in fact have tracking systems in place for regulating industry and specific requirements regarding hazardous materials management and disposal. The informal and legacy sites, however, remain largely undocumented and under-reported. The project team recommends building on the base of data available in the government registration materials along with the data that Pure Earth has collected on legacy and contaminated sites in each country to develop a comprehensive tracking database in each country. The database should have map views, allowing regulators and the public to find registered businesses that use or generate hazardous materials or waste, identify or report potentially contaminated sites, and locate transfer or disposal sites. An initial report was developed showing the precedent for this type of information in both countries and presenting a sample of how such a database could be developed and utilized by the government for tracking. It was noted in the final workshop in Indonesia that the government has been developing an online reporting system that could incorporate these suggestions. The report on the recommended database of hazardous waste sites can be found in Appendix B.

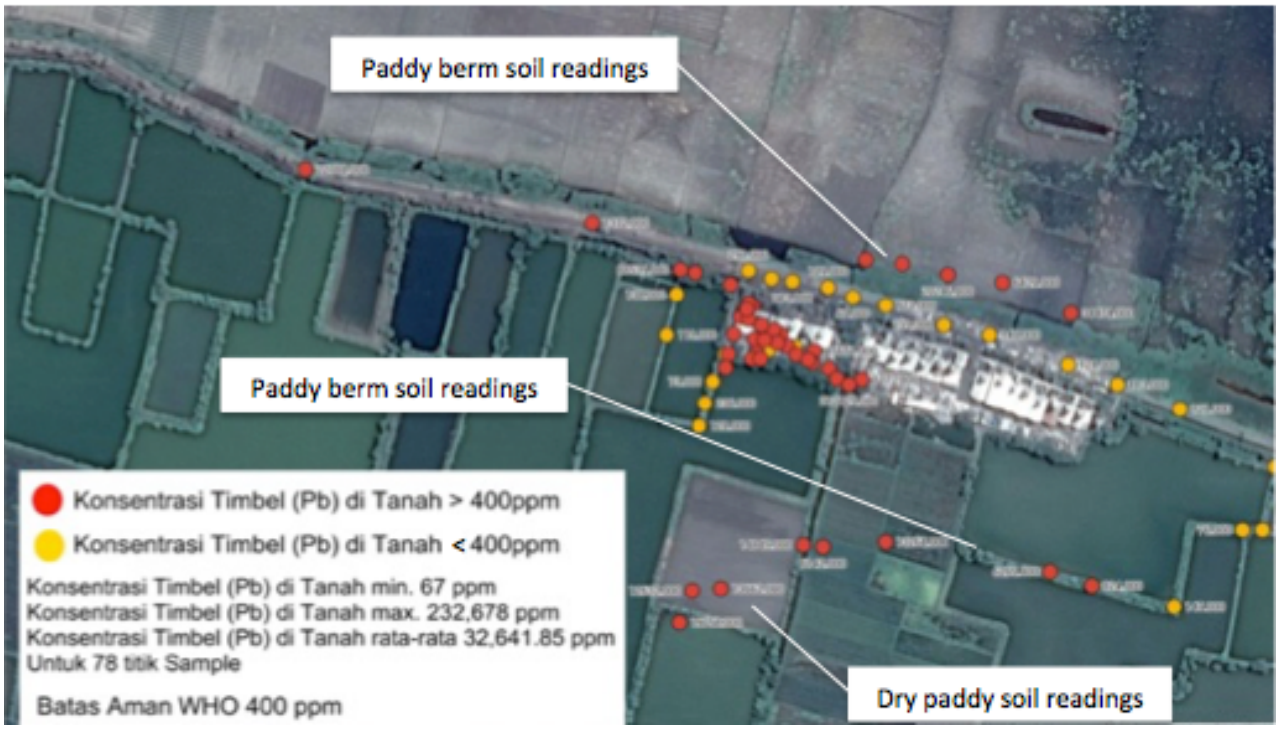
Figure 5: Residential and Water Lead Exposure Risk, Bulacan Province, Philippines

12. As part of the pilot site selection process, several contaminated sites were rapidly assessed during the TA. Rapid assessments utilized the Pure Earth Initial Site Screening protocol. Site investigations served to generate new data and maps, as well as to further the conversation with local and national government regarding contaminated sites. The investigations were conducted in concert with local and regional government regulators as part of the local capacity building support. The resulting maps, contamination reports, and decision-making tools regarding the human and environmental risks and best candidate sites in each area were then discussed extensively with government stakeholders. That data is included in the baseline reports prepared as part of the site selection process. The pilot site selection process itself and the environmental and social factors that were examined in addition to the contamination levels are discussed in further detail in the pilot site sections of this report. The image to the above shows the mapping completed for the former RAMCAR battery recycling facility where lead slag was dumped into the lowland, flood prone areas at the back of the property, abutting local fish ponds, wetlands, and a residential area. This lead

waste puts local residents at risk and is likely to impact the agriculture and aquaculture in the area.

13. The image below shows an industrial area that is surrounded by rice paddies and residences. Investigators found significant lead contamination of area soils. This presents a potential risk to a number of receptors. Possible exposure pathways include area soils, water, and food. Additionally as excess stalks are burned (as is common practice) any material that has accumulated in the plants is potentially aerosolized and deposited elsewhere. Further work is required to fully assess these risks as well as any occupational risks on site.

Figure 6: Occupational and Food Source Lead Exposure Risk, Lamongan, Indonesia



14. The table below presents data compiled from Pure Earth's review of toxic sites in the Philippines, highlighting the sources of contamination, the types of pollutants found, and the pathways through which the population can be exposed. Each of these sites presents a

potential risk to local communities and requires further assessment by the authorities. Many of these sites are within the Meycauayan-Marilao-Obando River System that flows into Manila Bay and houses many fisheries that supply Metro Manila.

Figure 7: Contaminants and Risk Factors, Select Polluted Sites, Philippines

No.	SITE NAMES	Years in Operation	Land Area (Hectares)	Population at Risk	Types of Key Pollutant	Level of Contamination (Exceedance of Standard)	Exposure Pathways
1	Aluminum Recycling Plant in Meycauayan, Bulacan	15	6	22000	Pb, As, Cr. Cd	410.95	Soil, Water, Food, Air
2	Former dump site of energizer battery San Jose Del Monte, Bulacan	18	6	2000	Pb, As, Cd	8536.66	Soil, Air
3	Treatment, Storage, Disposal (TSD) Facility, San Jose Del Monte, Bulacan	6	6	2000	As, Pb, Cd	70.06	Soil, Water, Air
4	Boom Town Industries in Brgy. Lalakhan, Sta. Maria, Bulacan	20	6	2000	Pb, Cd, Cr	189	Water, Air
5	Pyrotechnics Industry in Bocaue, Bulacan	50	10	2000	Hg, Pb, As, Cd	12.7	Soil, Water, Air
6	Former Used Lead-Acid Battery Plant, Meycauayan, Bulacan	22	13	14000	Pb, As, Cd, Cr	4438.29	Soil, Water, Food, Air
7	Manufacturing and ULAB recycling in Meycauayan City, Bulacan	30	6	2000	Pb, As	10496.24	Soil, Water, Food, Air
8	Open Dumpsite in Meycauayan, Bulacan	12	8	2000	Cd, Cr	16.1	Soil, Water, Air
9	ULAB recycling facility, Marilao, Bulacan	25	6	6000	Pb, Hg, Cd, As	43541.53	Water, Fish, Air
10	Former Used Lead Acid Battery Recycling Facility, Tambo	32	0.5	8000	Pb, Cd, As	15653.81	Water, Food, Air
11	Ship repair and building site along Navotas River	25	10	10000	As, Hg, Cd	495	Water, Fish, Air
12	Small-Medium Enterprises in Parañaque	27	0.5	0	0	0	0
13	Chevalier Enviro Services, Parañaque City	14	0.5	0	0	0	0
14	Multiple industries, Punturin-Lawang Bato and Bignay Creeks, Valenzuela	27	6	5000	Cd, Cr	230.91	Water, Air
15	Pandacan Creek, Pandacan, Manila	100	7	73000	Pb, Hg	10200	Soil, Water, Air
16	JM Ecotech Solutions Co. Caloocan City	8	0.5	1000	Cd, Hg, As	8	Soil, Water, Air
17	Clean Leaf International Corporation Malabon City	6	0.5	1000	Pb, As, Cd	117	Water, Air
18	UDENNA Environemental Services, Bagumbayan	27	0.5	100	Cd, As	18.57	Water, Air
19	G-six, Novaliches, Barangay, Bagbag	27	0.5	37000	Pb, As, Cd	76465.1	Soil, Air
20	Cathay Metal, San Bartolome	47	0.5	500	Pb, As, Hg	624.54	Soil, Air

15. The chart below presents lead in soil measurements taken near several informal smelters in Bogor Indonesia. Several of these sites indicated dangerously high lead levels and warrant further investigation and intervention to protect people living and working in the area.

Figure 8. Lead in Soil Measurements, Informal Smelters, Bogor Regency, Indonesia

No	Name	2005-2012		2014				# of Samples
		Average (ppm) 2005-2012	Population at Risk	Min (ppm)	Max (ppm)	Average (ppm)	Estimated Population at Risk	
1	Bogor, Cibagogo	66	100	9	147	71	200	50
2	Bogor, Cinangka	5,353	13,000	19	67,319	6,792	15,000	50
3	Bogor, Cinangneng	3,983	300	134	4,532	1,461	500	50
4	Bogor, Klapanunggal MT	67	100	22	130	83	1,500	50
5	Bogor, Klapanunggal KW	90	100	20	219	72	1,500	50
6	Bogor, Klapanunggal MD	614	300	15	908	313	500	50
7	Bogor, Parung Panjang AB	1,438	200	123	3,673	1,917	300	50
8	Bogor, Parung Panjang AG	1,449	200	65	3,923	1,236	300	50
9	Bogor, Parung Panjang AM	7,437	100	76	45,697	4,759	500	50
10	Bogor, Parung Panjang RB	342	100	54	3,121	503	300	50
11	Bogor, Klapanunggal MS	38	100	3	104	51	600	50
12	Bogor, Klapanunggal NN	138	100	19	185	102	400	50
13	Bogor, Cinangneng PS	830	3,000	19	2,928	877	3,000	50
14	Bogor, Cinangneng WH	214,300	500	891	15,299	7,478	500	50

HAZARDOUS WASTE MANAGEMENT TRAININGS

16. In addition to discussing identified toxic sites that require intervention with each government, the project team reviewed current oversight, regulatory, and management protocols in Indonesia and The Philippines. This exercise highlighted several key issues in the current hazardous waste management system in both countries:

    - Overlap of responsibilities between agencies or divisions and between national, regional, and local offices along with disjointed communications
    - Lack of monitoring and enforcement training and equipment
    - Large informal sector operating outside of regulations
    - Lack of awareness of requirements and best practices among small-scale operators

17. These issues were incorporated into targeted educational exercises held for government, industry, and community stakeholders in each country. A series of workshops was produced in both countries with topics including: Environmental laws and policies, mainstreaming hazardous waste management, public health effects and health

management tools, land use and zoning, remediation, and best available technologies in hazardous waste management. Detailed information about these workshops is included in Appendix A.

18. Several key resources were developed to support the training workshops, including:

    - Primer 1: Setting the Stage for Community Redevelopment: Steps for Initial Assessment of Identified Toxic Sites (27 pages);
    - Primer 2: Establishing Success Stories of Community Redevelopment Approaches for Contaminated Sites (15 pages);
    - Primer 3: Hazmat Quick Response and Safety Protocols (11 pages);
    - Health Assessment Checklist;
    - Household Hazardous Waste Training of Trainers Manual;
    - Smelter Assessment Training Handbook.

Figures 9 & 10: Sampling Discharged Water at a Tannery – Philippines; Assessing Smoke Hood, Industry Visit - Philippines

Figures 11 & 12. Smelter Assessment – Indonesia; Measuring soil contamination - Indonesia

19. All presentations were provided to workshop participants in print and digital formats. In addition to the workshops, hands-on training events were held, demonstrating how regulators can collect data at hazardous waste sites, reviewing current best practices with presentations and facility tours by industry representatives, and discussing issues related to informal or small-scale operators with industry and government representatives. The presentation materials can be found in Appendix A and on the project website.

20. As part of the training sessions for local and national government, Pure Earth also led hands-on demonstrations of the rapid site assessment process (Initial Site Screening; ISS) and shared data on local toxic sites. Pure Earth will continue to offer the rapid site assessment trainings in all of its project countries, but it has also made the materials available online and will make the toxic sites data searchable online by December 2016. Figures 9 through 12 show local government and Pure Earth consultants at a few of the training sessions.

21. To address industry best practices and regulatory oversight needs, Pure Earth engaged a technical consultant from the International Lead Management Center, Brian Wilson, to lead

a training session in each country. These sessions addressed the Basel Technical Guidelines for Environmentally Sound Management of Used Lead Acid Batteries and effective measures for assessing lead smelting operations and their safety along with environmentally responsible management and recycling of lead. Materials from those trainings are included in Appendix A. Participants in the Philippines were taken to gold shops and tanneries to observe best practices; test water quality, learn about ongoing pollution control efforts in the Meycauayan-Marilao-Obando river catchment in addition to the smelter assessment trainings. The local government in the pilot community of Pesarean in Indonesia also received detailed recommendations on technical and operational improvements to be made in the industrial zone outside of the village. Figures 13 and 14 show some of the demonstrated best practices for small-scale industry in both countries. A report on recommended best practices for industry is included in Chapter 5.

Figures 13 & 14. Lead Smelting Best Practice – Baghouse; Tannery Best Practice – Waste Water Treatment

HAZARDOUS WASTE REGULATIONS AND ENFORCEMENT

22. Many hazardous waste producers or handlers in LMICs work in the informal sector. These include those working in the following industries: waste haulers; used battery collectors, breakers or recyclers; backyard smelters; and scrap collectors in waste dumps. Regulatory

agencies should therefore consider the costs of compliance for small operators. It is a challenge for small-scale industry, particularly informal enterprises, to meet the regulatory standards for clean, safe, environmentally friendly operations. While it is preferable to many governments to institute very strict regulations, it is not always economically feasible for small-scale industries to implement cleaner technologies and/or meet stringent requirements. Their options are limited and they may choose to operate without declaring their activities, work at night or in secrecy, or opt out of the mainstream business community. This can result in dangerous activities operating outside of the law, informal industry being neglected in monitoring programs, affected people missing out on awareness building activities, and workers and communities being exposed to unsafe levels of toxins.

23. As part of the learning tours for government regulators, small business owners led discussions about how they were able to finance capital improvements, or were able to improvise or build their own systems to protect the environment and workers' health. Additionally, government and industry stakeholders discussed the challenges in monitoring and improving operations in the informal sector. Key takeaways from those discussions were that access to capital is needed for improvements or upgrades to facilities or machinery. The stakeholder groups highlighted the need for clear identification of appropriate and compliant technologies for various industries and the need for a process in making suggestions for those decisions so that alternatives can be considered and compliance can change as technology and practice changes

24. Recognizing that regulations must be enforced, stakeholders suggested that if the government is willing to allow informal operators to become formal, compliance plans and milestones and deadlines should be outlined. It is noted that the idea of allowing informal industry to comply and then become formal was met with some disagreement among government agencies during workshops in Indonesia. This is a position the government will need to clarify before progress can be made.

25. An additional suggestion from stakeholders was that government could provide incentives to upgrading facilities and moving to better locations in the form of:

- tax breaks for converting operations or purchasing clean technology
- subsidized rent at industrial locations (to encourage relocation from residential areas)
- access to clean technology at a co-location, industry-friendly area for shared use
- Policy and Enforcement Dialogues

26. As part of the stakeholder education and engagement in the TA, dialogues were initiated to identify challenges and gaps in policy and enforcement, allow participants to make suggestions, and respond to recommendations. The results of those meetings are discussed below.

27. Frequently, discussions related to informal operators and hazardous waste involve stricter enforcement and closing down informal operators as the answer to preventing hazardous exposures and scaling back illegal, unregulated activities. This is an over-simplification unfortunately. It must be recognized that the informal sector exists because of economic choices by owners and workers, the barriers to entry into formal operations, and the incentives or disincentives to compliance with regulations. Policies and regulations involving the informal sectors should be tempered with an understanding of the economic value that the sector commands—the number of people employed, the support that is provided to the formal sector, and the significant amount of income generated by these businesses.

28. It is also important to consider the purpose behind the regulations and the outcomes associated with strict enforcement of laws. If stringent lead smelter emissions regulations are established in order to protect the health of workers and nearby residents, what will happen when the government begins shutting down local smelters in a village? Sudden enforcement of regulations regarding emissions and discharge requirements often results in operators going “underground”—either moving to more rural villages, hiding their activities by burning or dumping at night or moving behind guarded, high walls, all of which potentially expose others to toxins. Often, operators may be breaking the law because they do not understand the regulation, do not have adequate internal quality controls, or are not capable of meeting the requirements because of capital or personnel constraints. Government policies must be developed in the context of the capacity for enforcement that exists nationally, regionally, and locally and also the capacity for compliance of both the

formal and informal sectors. Otherwise, hazardous waste regulations go unenforced or hazardous waste generators shift contamination problems to new regions.

29. Under this TA, policy discussions were held with a stakeholder group comprised of government, industry, informal operators, and local community representatives. Gaps in enforcement capability, compliance capacity, and resulting health risks were highlighted and incorporated into both training workshops and policy guidelines. Suggestions from stakeholders ranged from environmental audit programs to inform operators of steps needed to come into compliance, recognition programs for companies operating above the minimum standards, and generous compliance timelines to encourage and support changes in practice at the local level. Key policy issues and recommendations that came about under this project are addressed on the following pages. It is anticipated that the responsible agencies within the target governments will utilize the experiences from this TA to inform future law enforcement, regulator trainings, and policy development. Related recommendations are also included in the "Action Plan" for each pilot government included in the pilot project sections of this report.

Philippines

30. In the Philippines, the relevant legislation reviewed under this TA included:

- the Philippine Clean Water Act of 2004 (RA 9275)
- The Ecological Solid Waste Management Act of 2000 (RA 9003)
- The Philippine Clean Air Act of 1999 (RA 8749)
- the Toxic Substances and Hazardous and Nuclear Wastes Act of 1990 (RA 6969)
- The Environmental Impact Statement System of 1982 (PD 1586)
- the DENR Administrative Orders for Self-Monitoring Reports, EcoWatch, and Philippine Environment Partnership Program - PEPP (2003-27,26, and 14 respectively)
- The National Strategy for the Management of POPs Contaminated Sites in the Philippines (Feb 2016)

31. The Philippines government has implemented a coordinated program of hazardous waste monitoring and management and legislation meant to prevent pollution and dangerous exposures. The online manifest system and self-reporting mechanisms, along with the detailed hazardous waste data provided by Pure Earth, World Bank, and other organizations, could allow an online, real-time data inventory of hazardous waste areas to be monitored in the country. The legislation listed above addresses hazardous waste and pollution. The challenge that now confronts the government is enforcement at the local level. Governments must ensure that local and regional planning, zoning, and oversight includes hazardous waste disposal and storage and reporting of hazardous chemicals, and that there is adequate education in the community to protect citizens and employees from toxins.

32. Conversations with stakeholders, highlighted a need for coordination among local government units (LGUs) in order to address cross-border contamination issues, polluters who relocate between municipalities, and shared resources that become polluted, particularly rivers where pollution flows downstream from industry or dumpsites leach into groundwater. In response, the project team worked with the local Water Quality Management Association (WQMA), which approved the creation of an inter-LGU Council for Toxic and Hazardous Waste Management in Region 3. This can serve as a model for other WQMAs to adopt.

33. Another issue brought to attention during policy discussions was that many local governments are addressing solid waste but not including hazardous waste management in their local planning. The project team recommended that this be clarified so that LGUs are expected to include hazardous waste in their Solid Waste Management Plans as part of the “special wastes category” which currently only addresses medical waste and cosmetics. Additionally, zoning and future development planning must take hazardous waste disposal into account. Regulations regarding the segregation of waste must include hazardous waste, which cannot be shipped to the regular landfill. Special disposal requirements apply to different hazardous wastes. Therefore, hazardous materials must be identified and disposed of accordingly. Several related recommendations were made that included the

suggestion that junk shops be compelled to properly collect, store, and dispose of used lead acid batteries (a key source of toxic pollution in the Philippines), and also the suggestion that clear authority be given to local officials to suspend operations or close businesses that are not in compliance with environmental regulations. As part of this, a Pollution Control Officer position should be mandatory across municipal governments.

34. Communities, industry, and governments must be made aware of the health impacts of local toxic exposures. Currently, health data collected by barangay health workers does not include data on toxics-related illness. The TA team, along with the working group at the government workshops in 2016 recommended that public health audits should include environmentally-related illness, not only lifestyle-related illness. The training completed as part of the TA included a checklist for local health workers that identified the signs and symptoms of toxics exposures and information about necessary referrals for treatment (this checklist is available in the materials in Appendix A. Additionally, it was recommended that a Toxicology Center be established in Region 3 to build local government unit capacity and serve as a regional hub for regulator and public education and health statistics data tracking and response recommendations. This center would be a model to be replicated in other regions.

35. While the oversight of hazardous materials usage and disposal has been clearly detailed in the duties of the national and local governments, there is still confusion and lack of coordination because of the number of agencies involved. Currently, the Department of Environment and Natural Resources (DENR), particularly the Environmental Management Bureau (EMB) is the lead agency responsible for all for environmentally-related activities. However, there are several other powerful agencies that do not report to the EMB but whose activities directly relate to the management and oversight of hazardous materials: The Department of Health (hospital waste and public health statistics), The Central Bank (chemical imports), the Department of Trade (pollution control oversight), The Department of Transportation (licensing and spill responses), and The Department of Public Works (transfer stations and landfills). It is recommended that an inter-agency group be developed, led by DENR-EMB to coordinate the oversight of hazardous materials and effectively enforce

existing regulations. This will help harmonize the policies, protocols and programs of the various agencies and departments working on hazardous waste issues.

36. A related challenge is the difficulty in oversight and regulation of hazardous materials due to lack of training or coordination between departments. It is recommended that there be a Toxicology Center established in Region 3 as a model for other regions. This center will not only coordinate public health education and statistics monitoring, but will also serve as a training and resource center. Pure Earth has developed a model Mobile Lab in the region that could be replicated for government use in monitoring industry discharge, possible contamination, and water, air, and soil quality in all communities in the region. Additionally, the establishment of such a lab at the Toxicology Center will allow hands-on training of regulators and local officials in the use of the equipment, the types of hazards to be on the look-out for, and the current tracking mechanisms already in place that can guide monitoring and enforcement activities to prevent toxic exposures. One suggestion made in the stakeholder workshops was that partnerships could be developed with local universities and laboratories to provide necessary training and also to build capacity of future generations of regulators. Finally, it was recommended that local emergency response teams be trained in hazardous waste related disaster response and risk mitigation under the Disaster Risk Reduction trainings already in place nationwide.

37. Increased training and accessibility to equipment for rapid site assessments at the local level will improve enforcement and awareness among decision-makers regarding needed zoning changes, either the expansion of industrial zones or the relocation of unsafe activities if they are affecting local residential areas. Legislation and oversight mechanisms are already in place at the national level to track locations of businesses and the types of hazardous materials that are being utilized or disposed. It is recommended that local governments make sure of this data to guide frequent site assessments to monitor potential toxic releases, improper management, or increased risk to human or environmental health in their communities. Additionally, it is recommended that the sites registered and monitored in each LGU be geo-tagged and incorporated into a comprehensive database of industry, potential hazards, self-monitoring data, other site assessment data, and accident reports.

This data will support LGUs in decision-making regarding “polluter pays” enforcement, zoning recommendations, and protection of local residents. A related issue that came to light was that polluter’s fees calculations should include hazardous substances being processed and handled by a transporter or generator.

Indonesia

38. In Indonesia, the relevant regulations reviewed under this TA included:

- Law 41, 1999 on Air Pollution Control
- Law 82, 2001 on Water Quality Management and Control
- Law 18, 2008 on Waste Management
- Law 32, 2009 on the Protection and Management of the Environment
- Ministerial Decree 33, 2009 on Remediation of Hazardous Waste Contamination
- Law 27, 2012 on Environmental Permitting
- Law 101, 2014 on Hazardous and Toxic Waste Management

39. The environmental and hazardous waste management regulations in Indonesia are comprehensive and stringent. The existence of detailed regulations, remediation guidelines, and permitting requirements indicates an understanding of the complexities and dangers of toxins to local communities. The gaps identified by stakeholders highlighted that the challenges are not from lack of regulation but instead stem from issues related to enforcement, lack of infrastructure for compliance, and complications associated with multiple government ministries being involved in hazardous waste management and oversight. In order to effectively enforce the existing regulations, the infrastructure must be strengthened. This is achieved by addressing needs in industry, government, and technical capacity. Industry must be consistently monitored, permitting requirements must be met and enforced and then spot checks must be employed to ensure compliance, best practices must be taught and guidance provided for small-scale businesses for how to come into compliance. Government monitoring procedures must be formalized into a training curriculum for regulators at national, regency, and provincial levels. Technical

guidance must be developed to actualize the regulations for both enforcement and compliance.

40. The number of ministries and other agencies involved in hazardous waste regulation, compliance, and risk reduction further complicate effective oversight. The government entities involved in hazardous waste or toxin related work include the Ministry of Environment and Forestry (MOEF) (the lead agency for environmental protection and oversight of polluters), Ministry of Health (healthcare waste and health statistics), Ministry of Trade (business registration and compliance), National Development Planning Agency (zoning and economic development), The Environmental Impact Assessment (AMDAL) Appraisal Commission, the National Water Resources Board, and the Ministry of Remediation and Rehabilitation of Contaminated Lands. In addition to these nationally focused bodies, there are regency and provincial government units tasked with oversight and management in their respective domains.

41. In addition to the complications of the sheer number of agencies involved in hazardous waste management or remediation there is also a challenge in the rotation of staff between agencies. Because these projects tend to be long-term, it becomes difficult if key agency staff are moved to other departments or agencies are restructures in the midst of a remediation project.

42. It is recommended that communication and coordination be increased among these agencies through an inter-agency task force led by MOEF to strengthen enforcement and compliance activities and to serve as a repository for training curriculum and project management. An inter-agency group such as this could be a forum for consistent trainings of regulators, a repository for training materials and curricula, and a pooled source of the local environmental budgets and special allocations funds for the environment to purchase necessary site assessment equipment as well as a central authority to oversee remediation projects.

43. There is currently data collected in the registration, licensing and permitting, annual reviews, and other related oversight activities by the various government ministries involved that

could be combined with health and census data, site assessment data from Pure Earth and other organizations, business self-reported environmental monitoring plans, and regulator inspections from the PROPER (reviews by regulators that rank businesses according to their achievements towards operating in an environmentally responsible manner) in order to form a comprehensive database. Such a database would guide future efforts within the government to advise on needed zoning changes, contaminated lands to be remediated, and human or environmental health risks to be mitigated. It is recommended that the MOEF develop and maintain a database with geo-referenced points so that data collected by the various related ministries, regency and provincial government entities can be mapped and shared between decision-makers at each of the government levels. It was noted at the final workshop that the government is already implementing an online reporting system that could easily incorporate this data.

44. Involved stakeholders also suggested improving technical guidance and training on enforcement and compliance. The Indonesian government is particularly committed to ongoing training in smelter assessment, site assessment, and regulatory oversight and has worked with Pure Earth and other organizations to hold frequent trainings. It is recommended that these trainings be made into a comprehensive training curriculum for local and national level staff that can be delivered in-country on a regular basis.

45. In addition to technical training, the Indonesian government is creating detailed guidance for industry and regulators to ensure compliance with current environmental laws and to link those laws to practical action. Pure Earth consultants contributed to the draft documents currently under consideration by the government on used lead acid batteries and small-scale gold mining and mercury use. These documents include specific advice for existing operators to move towards compliance in order to address the current gap between very stringent regulations and an industrial sector that has many small or informal businesses that are unable to comply and are operating illegally or violating the agreements of their permits. The draft guidance documents submitted by the project team are included in Appendix C.

46. In discussions with technical experts regarding environmentally sound management of smelters, it became clear that particular technology must be installed in order to prevent pollution from industrial sites. These technological upgrades or retro-fittings require a financial investment, skills training, and ongoing maintenance. Some of the ideas discussed in the workshops were:

47. The possibility of licensed smelters providing a subsidy that would support informal operators in installing cleaner technology – a type of corporate social responsibility program.

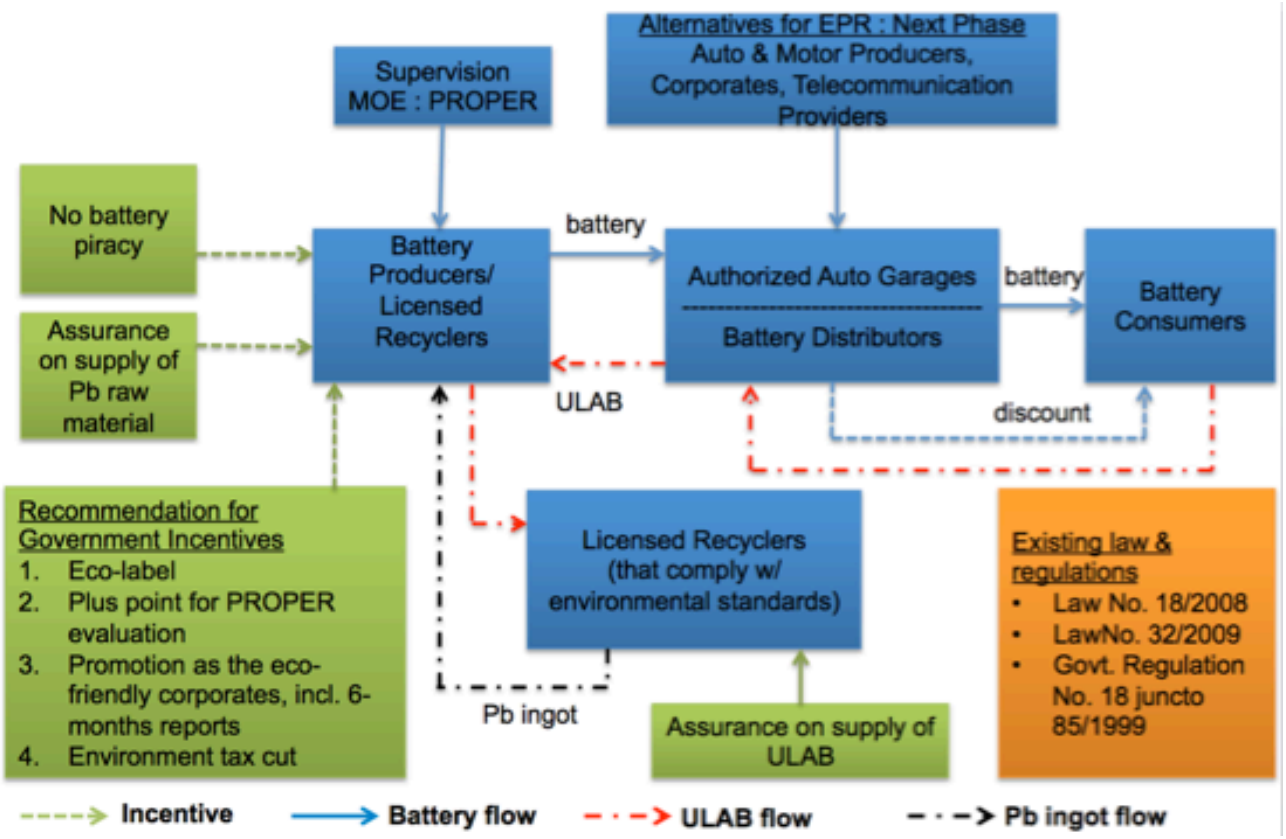
48. Informal smelters forming cooperatives to receive a license and obtain access to financing for technological upgrades. This idea was unpopular with the formal smelters who complained that they already have limited supply of batteries and that the number of licensed smelters should be limited.

49. Shifting informal smelters into battery collectors or transporters post-smelting rather than competing with the licensed smelters. This idea was unpopular with the informal smelters because they do not believe they would make the same amount of money as they do for lead. The formal smelters would have to pay a higher price for batteries received whole.

50. Government support to help informal smelters upgrade and comply with regulations. This idea was contentious among the various government agencies and the formal smelters.

51. The Indonesian government has also entertained several creative responses to addressing pollution from small scale industry, including Extended Producer Responsibility for used lead acid batteries, positive reinforcement through the PROPER and other incentive programs. Figure 15 below outlines some of these suggestions discussed with the Ministry of Environment and Forestry.

Figure 15. Suggested Alternatives for ULAB Management



52. In reviewing regulations related to this TA in both countries, it becomes clear that both governments have in place detailed, stringent laws regarding pollution controls, management, and disposal of hazardous waste. However an enforcement and compliance infrastructure should be developed both in the government and within industry (particularly small-scale producers) in order to bring activities in line with the legal framework.

ALTERNATIVE LIVELIHOODS

53. In addition to the legal framework behind the use, creation, or disposal of hazardous waste, the project team also reviewed the reasons for these activities. Why are people choosing these hazardous jobs and what if any alternatives might they have? The project team interviewed smelter owners and workers, tannery and gold shop owners and workers, and waste scavengers as well as the stakeholder groups attending project meetings and trainings to uncover the demand for and potential opportunities existent for alternative livelihoods.

Figures 16 & 17 Waste picker at smelter – Indonesia; Waste pickers at dump - Philippines

Possible Alternatives, Indonesia: Snack-making, metal handicrafts, junk shops, construction or agriculture services

Possible Alternatives, Philippines: Pillow-making, rug weaving, soap-making, junk shops, selling snacks or electronics

54. Interviews and discussions revealed that the metal recycling and the tannery or gold refining industries are relatively lucrative for owners. There is little desire to change occupations for the owners. Among workers however, the economic analyses indicated that employees (particularly in informal battery recycling or metal smelting operations) are typically paid a very small percentage of the business earnings. If alternative work were available at the same or higher wages, these workers would change jobs. Waste pickers were the most likely to desire more lucrative opportunities. Figures 16 and 17 show waste pickers in both pilot communities who would benefit from alternative livelihood programs, especially business development training, literacy and numeracy training, and access to capital.

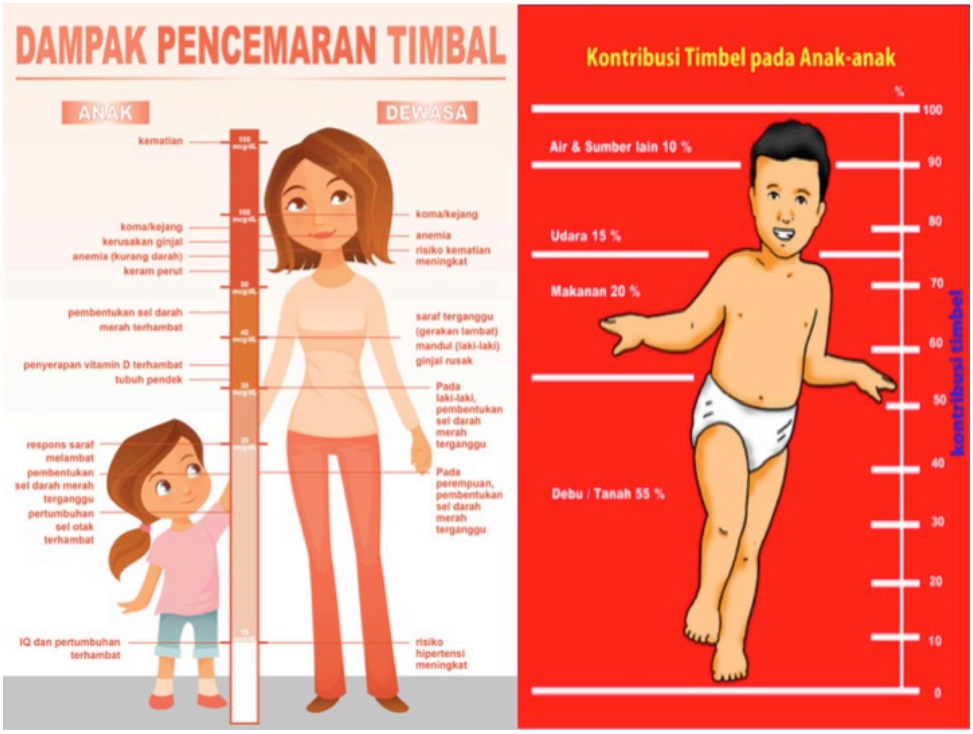
55. The team identified two main variables that would encourage a shift in livelihoods away from hazardous waste producing activities - either concern for health or a disruption in the value chain causing the work to make less economic sense. The discussions held with workers, owners, and local community members informed the educational and alternative livelihood sessions included in each pilot study. Further data on the alternative livelihood plans developed for each pilot area is highlighted in the Pilot Sites section of this report.

PUBLIC HEALTH EDUCATION

56. Lack of awareness is a major factor in the health risks of operators and workers at small-scale or informal operations that come into contact with hazardous wastes as well as their families, communities as a whole, waste pickers and haulers, those utilizing polluted waterways or those living on or near contaminated land. To address this knowledge gap, the project team partnered with the local health officials in the Philippines for small scale trainings to discuss common hazardous wastes that people in their communities may come into contact with, toxicity levels, and the warning signs of exposure or chronic exposures. The materials from these trainings can be found in Appendix A. Additionally, two

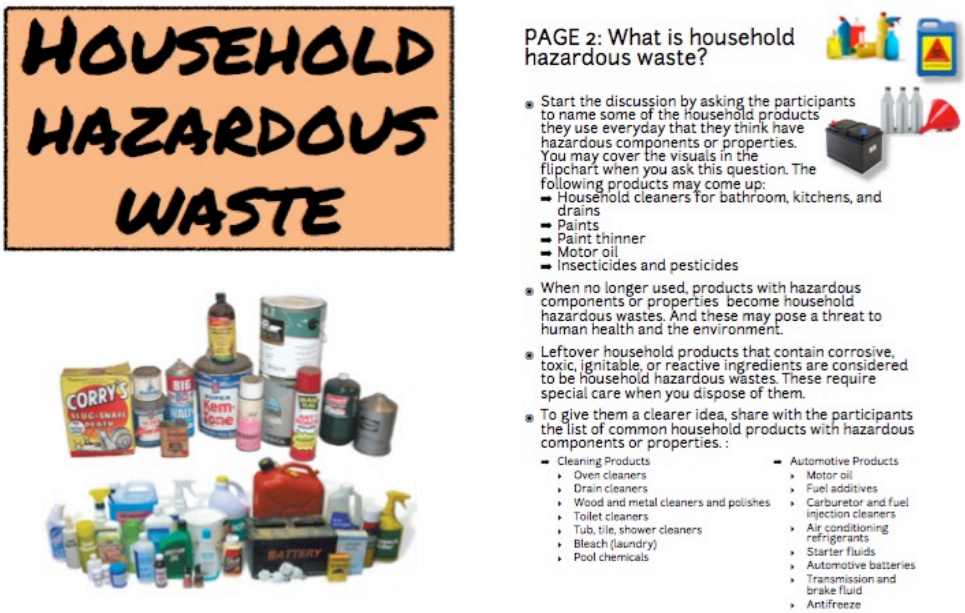
awareness-building videos were developed for stakeholders, one for government and industry focused on building a commitment to addressing toxic and hazardous waste issues and giving an overview of the related issues, and one for community members focused on common household hazardous waste and how to protect oneself and one's family. These were shown at various stakeholder events throughout the project. The videos are accessible on the project website. In Indonesia, public education has particularly focused on the health effects of lead. Public health education materials focused on the effects of lead were developed in 2010 in partnership with KPBB. Additionally, a comprehensive community education plan was developed as part of the Action Plan for the chosen pilot site in the village of Pesarean. This education plan and the health education materials previously created will also be shared with other local governments. The community education materials are included in Appendix A. Figure 18 shows two posters created in Indonesia about the health effects of lead.

Figure 18. Health Awareness Posters - Indonesia



57. While the TA project team incorporated several community awareness events into its research, the ongoing curriculum about protecting oneself and one's family from toxic exposures must be the responsibility of schools, local health workers, and community leaders. It is important to sustain these messages, preferably by incorporating them into existing curriculum. To that end, Pure Earth developed a Training of Trainers flipbook about Hazardous Waste and Household Risks that can be used as a resource for future training sessions. The flipbook is included in Appendix A and an image from the flipbook is shown in Figure 19. Additionally, detailed community training plans are included in the Action Plans for each pilot site and are shared publically on the project website.

Figure 19. Training of Trainers - Hazardous Waste Flipbook



ADB

Japan Fund for Poverty Reduction

JAPAN
Official Development Assistance

Ministry of Environment and Forestry,
The Republic of Indonesa

Department of Environment
and Natural Resources,
The Government of The Phlippines

PURE EARTH
BLACKSMITH INSTITUTE

Strategic Redevelopment Planning

The Philippines

Chapter 3

Chapter 3

Strategic Urban Redevelopment Planning, The Philippines

Table of Contents

CHAPTER SUMMARY

1. This is chapter three of the Final Report for The Technical Assistance Project: Mitigation of Hazardous Waste Contamination in Urban Areas: Supporting Inclusive Growth, TA8458. Other chapters of this report addressed the challenges of hazardous waste management and redevelopment of contaminated sites in general. They also provided recommendations from the project team on inclusive development, hazardous waste oversight, remediation and redevelopment of a contaminated site, and a completed pilot project in Indonesia. This chapter addresses the pilot project conducted in The Philippines as a demonstration of

addressing hazardous waste contamination through inclusive growth and urban redevelopment.

Site Selection

2. Five candidate sites were selected for review by the project team to nominate a Pilot Site for mitigation of hazardous waste contamination and a strategic urban development plan under the TA. Site visits were conducted between January 27 and 31, 2015. In addition, the team heard from national, provincial and municipal officials regarding public policy and the current status of hazardous waste mitigation within their jurisdictions at the Inception Workshop held on January 30, 2015. Municipal officials accompanied the team on site visits in the cities of Meycauayan and Valenzuela. During a meeting with the Planning Department in the City of Meycauayan, officials discussed policies and plans regarding several sites in their jurisdiction and provided links to pertinent planning documents, including a 2014 socioeconomic profile of the city. Likewise, officials of the City of Valenzuela provided helpful links to planning and socioeconomic data, including its Comprehensive Land Use Plan, 2009-2018.

3. To help evaluate the redevelopment potential of the candidate sites and assist the team in selecting a Pilot Site, the international land use and economic consultants developed a matrix that rates each candidate site according to 17 criteria that are essential for successful urban redevelopment. The criteria, which were presented and discussed at the Inception Workshop, focus the evaluation on four principal factors that are intrinsic to redevelopment in urban areas, including:

    - Physical characteristics of the site
    - Socioeconomic characteristics of the local population, business and industry in addition to fiscal considerations that may influence investment decisions
    - Public policy (national, provincial and municipal) regarding hazardous waste contamination and management
    - Land use patterns and zoning regulations that permit or constrain development, particularly with regard to open space

4. The matrix rates how well each site meets each of the 17 urban redevelopment criteria on a sliding scale from 1 to 4, with 1 indicating that site characteristics would constrain or limit redevelopment and 4 indicating that the site substantially meets the criteria and would strongly support redevelopment. Not all criteria are equally important to the redevelopment potential of a site, so the criteria themselves are rated 1, 2 or 3 with 1 being the least important and 3 being the most important. The score for each criterion is achieved by multiplying the criterion rating by the importance of the criterion. The 17 scores for each site were summed to provide an overall evaluation for each site. This analysis highlights the redevelopment potential of each site from a land-use and urban planning viewpoint.

ASSESSED SITES

Site One: Border of Punturin Creek, Valenzuela

5. Site 1 is located in Barangay Punturin. The land-use of Punturin is categorized as agriculture and is part of the city's 89.7 hectares of land allotted for agricultural production (approximately 2% of the city's total land). However, there are still remaining areas allotted for agro-industrial uses. Based on the existing land use classification of the City (2009), Punturin has 28.39 hectares allotted for industries. Green Planet Management, Inc., a DENR accredited treatment, storage and disposal (TSD) facility is nearby. Other local industries include steel, metal and plastic manufacturing.

Figure 1: Punturin Creek

6. Punturin Creek flows near the industrial area. Downstream, approximately 10 to 20 informal residences are located along the east bank of Punturin Creek, at the end of a narrow road. A gated single-family residential community known as

Maraming is also located nearby. Houses here are typically two stories and contain approximately 100 to 200 square meters of space. Several vacant lots were also observed within the Maraming community. A cinder block wall separates an adjacent industrial area from Maraming and the informal housing on Site 1.

7. When the team performed the assessment in Punturin on November 6, 2014, the water body changed in color over a brief period of time: from light orange, to green, then to black. According to the residents, this is typical; sometimes the water is white, blue or red. The residents also noted that there are times when it smells like oil. Out of the 18 points assessed XRF analysis, one sampling point exceeded internationally cited standard for As, Cd and Pb. Another point exceeded the standard set for Cd. The water sample from the creek, on the other hand, yielded 0.09 mg/L or 90 ppb of Cr, which is above the standard level for drinking water (WHO 50ppb) and a little below the standard level for irrigation water (FAO 100ppb). According to the residents, they do not use creek water. They have a dug bore well for domestic water use.

8. While there is a small community of informal settlers, there is an expectation that the informal residences will be relocated in conformance with the Philippine Water Code stipulating the following: “The banks of rivers and streams and the shores of the seas and lakes throughout their entire length and within a zone of three (3) meters in urban areas, twenty (20) meters in agricultural areas and forty (40) meters in forest areas, along their margins are subject to the easement of public use in the interest of recreation, navigation, floatage, fishing and salvage. No person shall be allowed to stay in this zone longer than what is necessary for recreation, navigation, floatage, fishing or salvage or to build structures of any kind.”

9. Site 1 itself is extremely narrow and offers little to no redevelopment potential. It has the lowest score on the Evaluation Matrix, with a total of 50 out of a maximum 124. However, the relocation of the informal residents and removal of the informal housing could result in some land use benefits by providing an opportunity for new open space and greening of the river bank.

Site Two: Caingin dumpsite, Meycauayan

10. Site 2 is privately owned by Jamar Corp. It's a former open dumpsite located inland in Barangay Caingin, adjacent to a tributary of the Meycauayan River. To the east is the neighboring Barangay Lawa and across a narrow inlet to the south is the City of Valenzuela. Barangay Caingin has a land area of 54.72 hectares and a population of 4,763.

11. Until recently the city used Site 2 as a municipal landfill for household garbage and refuse. Both the Environmental Management Bureau Region III and the City Government of Meycauayan report that the landfill, which covers approximately 4 hectares, was officially closed in 2010. However, field observations from the site visit indicate that the site's borders are uncontrolled and remain largely open. There is potentially ongoing illegal dumping, scavenging and open burning on the site. In addition, substantial amounts of the landfill's contents have spilled into the river, which moves slowly as it curves around the site, so that the surface of the waterway is completely filled with refuse. There are also about 15 informal houses at the site. Two XRF surface soil sampling points registered 25.5 and 30.1 ppm of Cadmium which are both above the recommended level of 1.4 ppm for agriculture areas and 14 ppm for residential areas but below the industrial limit of 192 ppm.

Figure 2: Caingin dumpsite

12. As noted in the evaluation matrix, the size of Site 2 makes it attractive for redevelopment. The site scored highly in several other land-use and redevelopment criteria, including transportation access, recent investment, the potential to support uses similar to those in the surrounding area, and the potential to improve neighborhood character. For example,

the site is only 6 kilometers from the N. Luzon Expressway. In addition, a review of a 2014 Socioeconomic Profile prepared by the City of Meycauayan shows significant recent public and private investment close to the landfill. The Meyland Homes subdivision located in the adjacent Lawa Barangay includes 557 units of government or social housing. Another 663 homes were developed in the Ciudad Grande North subdivision in Lawa. The Villa Samantha subdivision located partially in Caingin and Lawa contains 536 homes. Overall, investment in the area since 2010 has resulted in 277,926 sq. meters (68.7 acres) of residential development containing a minimum of 1,820 housing units. In terms of services and utilities, Caingin has a health center, schools, potable water supply, telecommunications and electricity.

13. The major sources of livelihood in the area are: leather tanning, jewelry making, trading, piggery and services employment. The investment activity, along with several other evaluation criteria, resulted in a score of 83 for the Caingin landfill site, the fourth highest among the five candidate sites in the Metro Manila-Bulacan regions, indicating comparatively high redevelopment potential.

Site Three: RAMCAR, Meycauayan

14. The RAMCAR site is a former used lead-acid battery recycling (ULAB) plant occupying 13.7 hectares in Barangay Bancal. The lead recycling facility operated from 1978 to 2000. The building that housed the recycling operation has been demolished, though the contaminated soil from the battery recycling inside and adjacent to the facility compound as well as the areas where slag is likely buried has not been remediated. Although the facility closed and was sold off in parcels to several private owners, the property is being guarded to prevent access to the interior, though it appears that local residents are still gaining

Figure 3: RAMCAR

entry.

15. During a 2008 assessment, community interviews revealed that scavengers collected scraps from inside the site from which they could still extract lead. According to some community members, scavengers paid P 10-20 pesos and even P 100 pesos to get inside the facility. The nearby informal settlers also used battery casings as flooring and around their homes.

16. A section at the border of the site is currently occupied by informal settlers, posing a grave health danger to the residents, particularly children. The informal settlers are part of Barangay Tugatog, which borders Bancal. In a 2010 study, a total of 103 people resided in the area. There were 22 families with an average household size of four to six. A majority of the residents were female (60.20%) and more than one-third were children aged 0 to 12. The Department of Health (DOH) and University of the Philippines – National Poison and Management Control Center (UP-NPMCC) in partnership with Blacksmith Institute conducted a health assessment study to determine the Blood Lead Level (BLL) of children living near the site in 2010. Out of 76 children ages 6-7 years old tested, 12 children had a BLL of more than 10μg/dL, with some as high as 65 μg/dL, the upper limit of detection for the Lead Care II analytical device. The Center for Disease Control (CDC) advises chelation therapy for BLLs 45 μg/dL and higher and is concerned if children's BLL reaches 5 μg/dL or higher. In addition to this, a Blood Lead Level monitoring of people living adjacent to the site was conducted in July 2010. A total of 20 female and 10 male residents were tested. Twenty-four of those tested were children younger than 12 and six were adults. A majority (75%) of the children were underweight while half of the adults who participated in the assessment were undernourished. Half of the children showed enlarged lymph nodes. All of the patients had upper respiratory infections and dental caries. Two of the adult patients reported fatigue and lethargy. The BLLs were determined using an FDA approved Lead Care device. The soil sample readings at that time registered as high as 76,000 ppm tested via X-Ray Fluorescent Analyzer and 25,000 ppm via Atomic Absorption Spectroscopy Analyzer.

17. In 2014, within the context of the planned North Luzon Railway Project, RAMCAR in coordination with the Environmental Management Bureau of Region III completed a remediation just outside of the walled property that is part of the North Luzon Railway Corporation (NLRC) property. The site was re-assessed under this TA and results showed fourteen of forty-four points exceeded the soil screening criteria for lead, arsenic, cadmium and chromium.

18. Environmental and health risks are more pronounced in this site than in several of the other sites assessed. However, if it were remediated, the site would have excellent redevelopment potential based on its size, location and the land use characteristics in the surrounding area. The site encompasses approximately 14 hectares (34 acres), occupying about 20 percent of the barangay, and represents the largest single under-developed property in the barangay. Like the Caingin landfill, the RAMCAR site is located near recent large-scale residential developments and is very accessible. Overall the site earned a score of 100 out of 124 in the land use and economic development evaluation.

19. The barangay itself is densely developed with residential, commercial, industrial, and institutional uses, primarily due to its location along MacArthur Highway, one of two major north-south transportation routes serving Manila. Among the important institutional uses is Meycauayan Doctors Hospital, a full-service medical center located within a few hundred meters of the former main gate of the RAMCAR facility and several educational facilities. Not far from the site is the Meycauayan City branch of STI College. A wide range of commercial uses are also present in the vicinity of the RAMCAR site including a branch of Puregold Price Club, a major supermarket and general merchandise retailer in the Philippines. In addition, there are several banks, auto dealerships, business services, pharmacies, and restaurants nearby. One of the principal industries in the barangay is leather tanning. C.G. Lejano Leather, a major supplier to Hickok Leather, maintains a facility within a few hundred meters of the site.

20. The southern edge of the site borders the planned North Luzon Railway. Construction activities would likely remediate any contaminated areas immediately adjacent to the

RAMCAR site. However, operation of the railroad could constrain redevelopment opportunities in the southern portion of the site, particularly for potential residential development by creating a barrier to access and possible noise, vibration, and visual impacts.

21. Assuming the effective remediation of the RAMCAR property, the site is well situated for redevelopment. The property offers a strategic mix of assets to support redevelopment, including adequate size to accommodate one or more compatible land uses, a regular configuration and excellent transportation access. In summary, the site is in the midst of a highly developed urban core that brings together a residential population with prominent commercial, institutional and industrial uses that would make the site decidedly attractive for urban infill development.

Site 4: Lingunan Landfill, Valenzuela

22. The Lingunan landfill site occupies approximately 13 hectares of the 11,590 hectares in Barangay Lingunan within the City of Valenzuela. The Lingunan Controlled Dumpsite was opened in 1998 to process about 60% of the entire city's waste with land filling, recycling, segregation, and resource recovery services. The dumpsite used rice hull ash as daily cover and odor control material. In 2006, the dumpsite was closed per MMDA order and was subsequently converted into a sanitary landfill as directed by RA 9003.

Figure 4: Lingunan Landfill

23. Like the Caingin landfill, this site is adjacent to the Meycauayan River. Residential areas appear to border the site on the east and northeast, while industrial uses and a large open area border the site on the south. Major

industrial uses located nearby include the Plastic City Corporation, Bestank, Ginebra San Miguel (non-alcoholic bottling facility), and the Splash Corporation, which manufactures health products distributed internationally. There is a vibrant commercial district close by with a concentration of retail food stores, general merchandise stores, clothing stores, paint and hardware stores, banks, auto parts retailers and suppliers, and motorcycle sales. The site is also close to the recent residential developments in Lawa and Caingin Barangays in the City of Meycauayan, and is approximately 5 kilometers from the N. Luzon Expressway.

24. The Lingunan landfill scored third highest among the five sites compared in the land use and redevelopment evaluation, a total score of 98 out of a maximum score of 124. Some of the significant characteristics that support redevelopment of the site include its size, nearby recent investment (both residential and industrial), access, and proximate land uses similar to those that might be developed on the site, including residential and commercial. But perhaps the most important asset for the Lingunan landfill site is consistency with public policy. The City of Valenzuela has already closed part of the landfill and stands ready to meet the challenge and opposition from the current private landowner to close the remaining portion of the landfill.

Site 5: Pandacan Depot, Manila

25. The Pandacan Petroleum Depot occupies 33 hectares along the south bank of the Pasig River in south Manila. It is an extraordinary urban development site given its size (about 74 acres or 3.2 million square feet), proximity to major upscale commercial and residential developments in central Manila, relatively clean condition, 51% public ownership, ongoing relocation and abandonment of

Figure 5: Pandacan Depot

storage tanks, and apparent public support for the policy to close the remaining petroleum storage facilities.

26. The site is occupied by the three major petroleum industry players: Shell, Chevron, and Petron. Its existence in a densely populated area is considered to be in non-compliance with the prescribed buffer zone separating industrial areas and residential and commercial areas.

    - Reported incidents caused by the depot include the following:
    - 1997, two Shell oil tankers exploded inside the oil depot complex
    - 1999, a pipeline leak was the source of fires in Muntinlupa City with one fatality
    - 2008, a tanker caught fire at the Nagtahan fly-over, killing one and wounding another
    - 2010, the FPIC underground pipeline leaked oil into West Tower Condominium in Barangay Bangkal, Makati

27. Health effects of the depot have also been studied. “In 2005, the University of the Philippines College of Medicine conducted the study, *A Cross-Sectional Study on the Neurophysical Effects of Exposure to Refined Petroleum Products Amongst Adult Residents in Three Barangays near the Pandacan Oil Depot*.” Among the study’s findings is that the number of cases of neurophysical disorders in the area have been progressively increasing. In the same year, a health survey found high levels of benzene in the air surrounding the oil depot, problematic because benzene is a known carcinogen that affects the nervous, respiratory, and immune systems.

28. Water sampling was performed in Estero dela Reina, one of the Pasig River tributaries near the Pandacan site. The analysis confirmed 15,200 ppb of lead, though the presence of other industries, establishments and informal SMEs in the area make it difficult to attribute this finding directly to the oil depot.

29. The Pandacan Depot scored 101 out of a maximum score of 124 on the evaluation matrix. Despite the high score, there are a few key considerations the team should take into account when considering the Pandacan Depot as a potential pilot site. As a very large,

industrial site run by international corporations, this site differs from the other individual, small-scale, or medium-scale enterprises considered under the TA that are more likely to serve as models for low- and middle-income countries in the region. Additionally, it is such a large site that the redevelopment and remediation would take additional time to complete and to show an impact. Therefore, it was determined that this site was not ideal for the TA, as it should be remediated by the private companies responsible for the contamination. Taking all of the findings into account, the team with approval from DENR-EMB chose RAMCAR (Site 3) as the pilot site for the Philippines.

Selected Pilot Site, RAMCAR

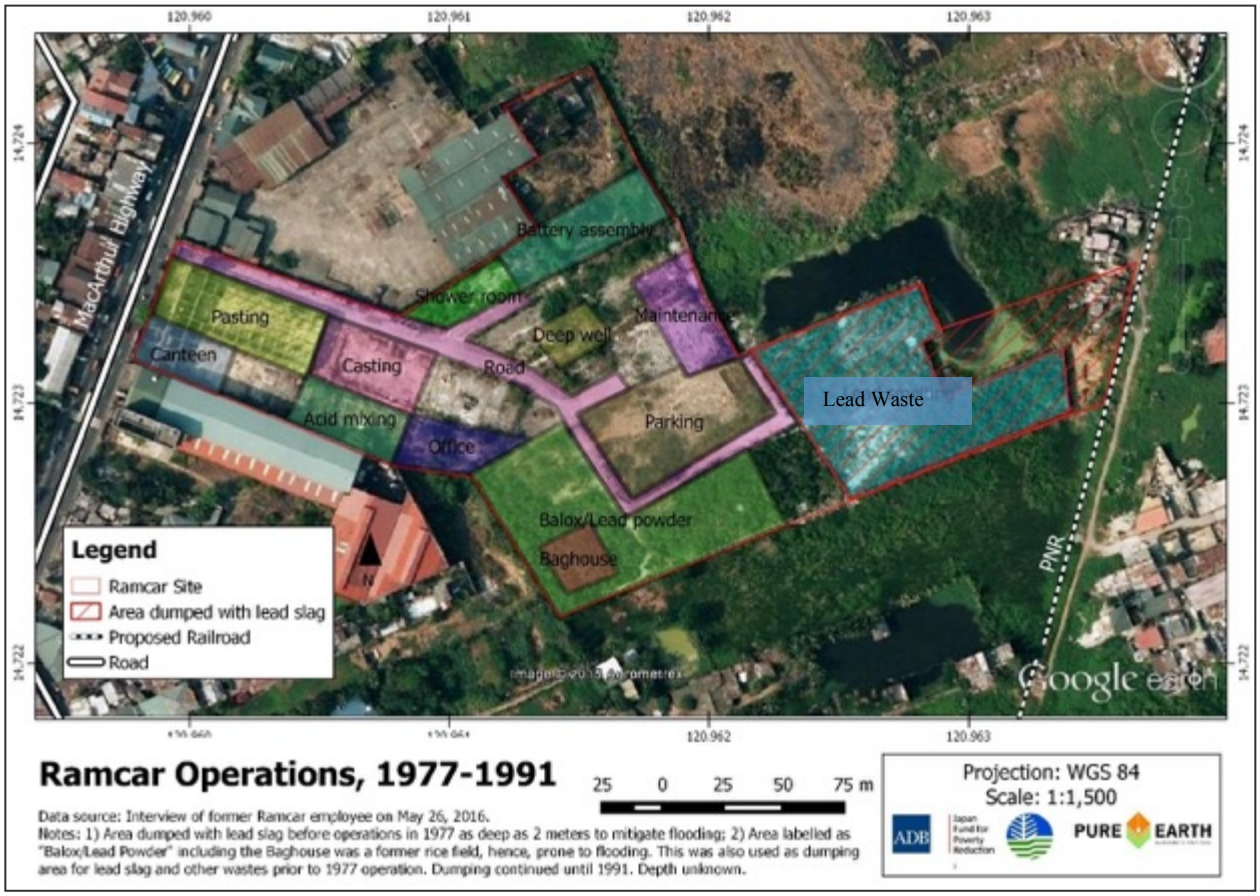
30. The pilot site chosen in The Philippines for this TA is a 13.7 hectare former used lead-acid battery recycling plant located in Barangay Bancal, just at the border with Barangay Tugatog, in Bulacan. The site borders the railroad right of way owned by the Philippine National Railroad (PNR) that is to be developed in the expansion of the North Luzon Railway Project. The area where the site is located is zoned for residential and industrial use. The site is located along busy MacArthur Highway, with shopping, commercial establishments and the successful ITC Woodlands housing development. The site's size and location make it an ideal redevelopment planning site. The site is shown in the Figure 6 below.

Figure 6: Pilot Site Location, Philippines

History of Operation

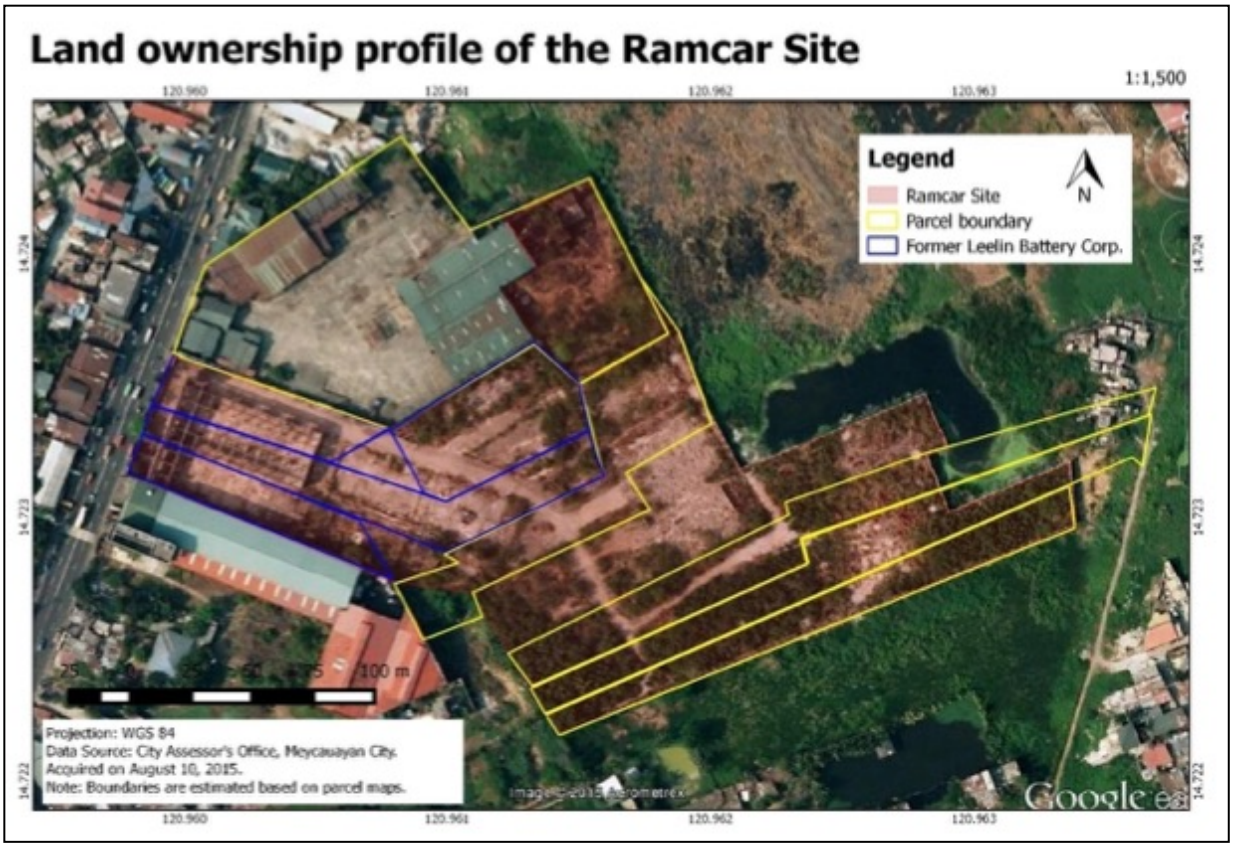
31. The lead recycling facility operated from 1978 to 2000. There were little to no emissions or discharge prevention systems in place when the plant was operating. According to an interview with a former plant manager, battery acid and liquid wastes from the facility were poured directly into the MacArthur Highway drainage system and slag and other lead-filled waste were dumped into wetlands at the rear of the property without proper pre-treatment or solidification practices to prevent spread of contamination. The building that housed the recycling operation has been demolished, but no remediation or cleanup was conducted. The locations of former operations are indicated in the image below:

Figure 7: RAMCAR Operations



32. Although closed, the facility is still being guarded by the previous owner and is privately owned by new owners who do not have access to the site. The image below shows the parcels that make up the site.

Figure 8: Site Parcels



33. The RAMCAR facility in Meycauayan City operated as a battery and used lead-acid battery recycling center for 25 years. RAMCAR was founded in 1919 as an automotive electrical shop in Manila. The original used lead-acid battery recycling plant was in Gen Luis St. Novaliches, Quezon City and later moved to Bancal, the Meycauayan site in the 1980s. In 1989, the Meycauayan plant reached its maximum capacity rate of 12,000 tons of lead recovered per annum. The recycling facility was later transferred to Marilao to cover the increasing demand for soft lead bullion and hard lead alloys (Table 1). In 1997, two of the

biggest motor battery manufacturers in the Philippines, C.C. Unson Company that manufactures Motolite battery, and RAMCAR Inc. that produces Oriental battery, merged to become Oriental and Motolite Corporation (OMC). C.C. Unson started as an importer of motor batteries mainly from States Battery Parts of Seattle, Washington.

34. In 1991, RAMCAR renamed itself Philippine Recyclers, Inc. (PRI) and later transformed into Green Planet, bought out First Metal Specialists, Inc. (FMSI) and took on the latter's battery recycling operations. This ended the dependence of the company on imported primary lead. In addition, local and international pressures for stricter control of hazardous wastes and materials was adopted in 1989 and enforced in 1992 through the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal. The Philippine Recyclers, Inc. (PRI) became the largest secondary lead smelter in the Philippines. The company also implemented several Corporate Social Responsibility (CSR) projects such as Balik Baterya in partnership with Philippine Business for Social Progress (PBSP) and Bantay Baterya with Bantay Kalikasan of the ABS-CBN Foundation, Inc. (AFI). Both programs center on requesting private companies to donate their ULABs for proper handling and recycling, the equivalent amount or proceeds of which go to PBSP's and AFI's development projects (i.e. electrification of classrooms, rehabilitation of watersheds, etc.).

Figure 9: RAMCAR Recycling Plants

35. Year	36. Lead Production (tons/annual)	37. Plant
38. 1981	39. 7,200	40. Meycauayan Plant
41. 1989	42. 12,000 (maximum capacity)	43. Meycauayan Plant
44. 1990	45. 36,000	46. Marilao Plant

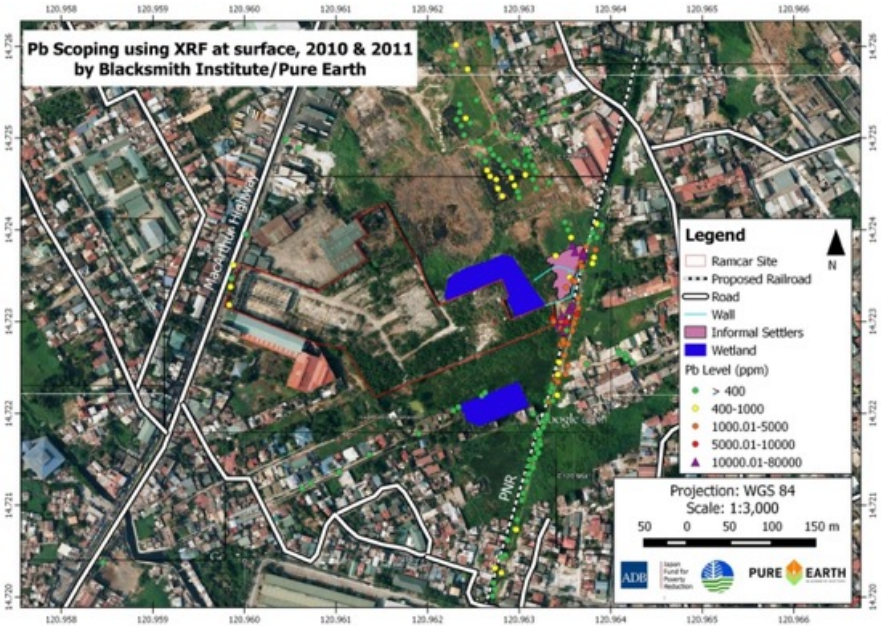
BASELINE STUDY

47. The site was assessed for this project using a Conceptual Site Model to review the contamination, source, estimated extent, exposure paths, and potential remediation techniques.

Contamination Source

48. Site contamination was first investigated when Blacksmith Institute conducted an assessment of heavy metals in surface soil at selected locations in Meycauayan City in 2008. Soil lead levels near the RAMCAR site where informal settlers live ranged from 1,500 – 200,000 ppm, which is above the permissible level of lead in residential soil of 400 ppm (according to USEPA standards). The discovery of the lead contaminated site led to a joint 2010 project between Blacksmith Institute, RAMCAR represented by Leelin Corporation, and the Environmental Management Bureau Region III. Results of the assessment showed that several points near the wall and the railroad where the informal settlers reside had lead levels exceeding the permissible level of 400 ppm. The lead levels on surface soil during that time ranged from 12.10 to 76,033.20 ppm. Levels in front of the facility ranged from 400.01 to 1,000 ppm. The surface lead measurements are presented in the map below.

Figure 10: Surface Lead Measurements, RAMCAR

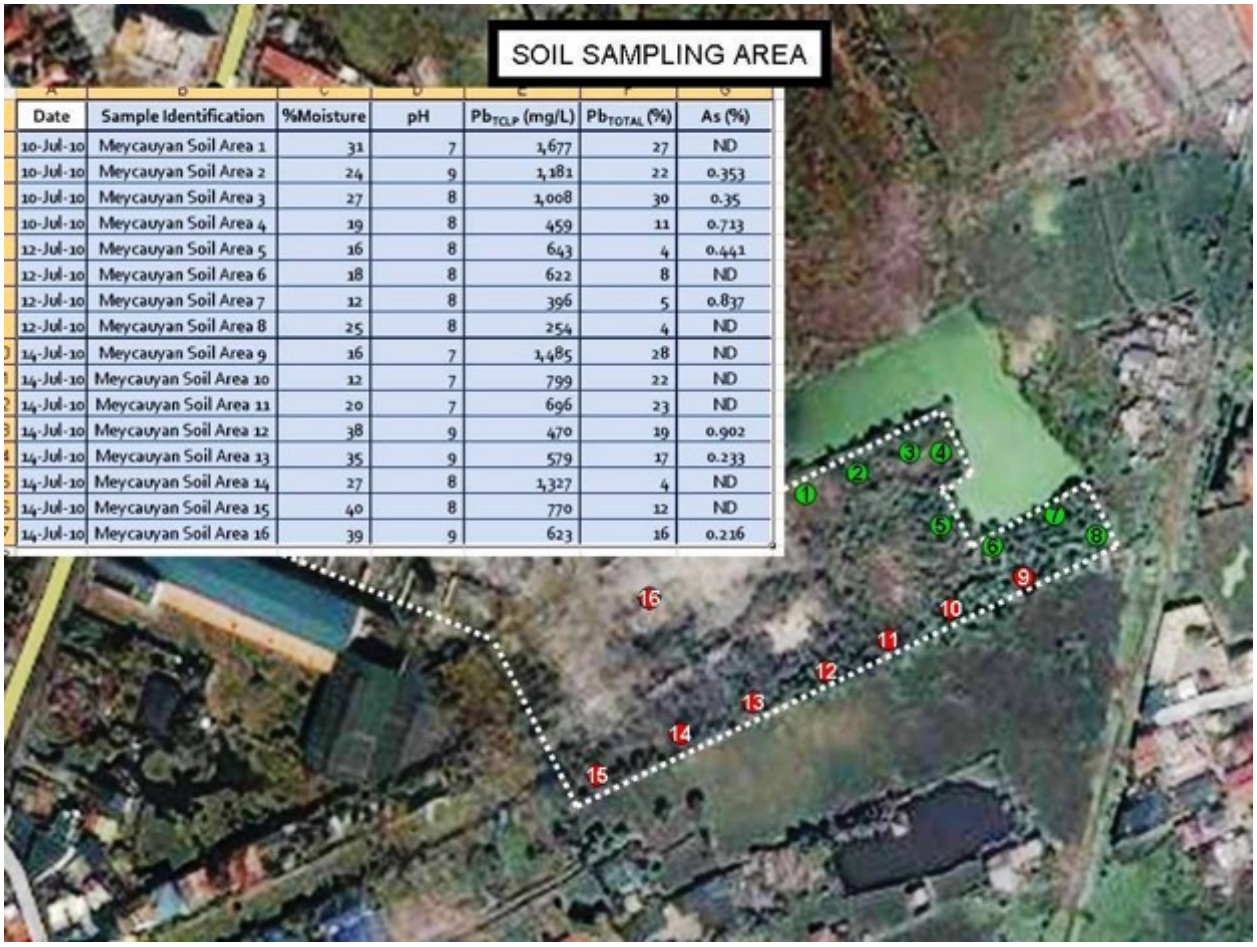


49. Sampling went as deep as 1.0 m. Results showed that lead levels outside the facility decrease as sampling depth increases. This indicates that contamination outside the wall and near the former railroad is mainly concentrated on the surface from deposition. However, samples collected in front of the facility showed increasing levels of lead with deeper increments from surface to 0.50 meters. This is indicated in the image below. This is attributed to a number of highway renovations since 2000 where clean soil has been dumped to elevate the area due to flooding. It is anticipated that there are also several areas where waste was buried and the contamination would be much deeper.

Figure 11: Depth Measurements, RAMCAR

50. Leelin Corporation conducted a parallel assessment inside the RAMCAR facility. Assessment results showed that lead levels after the Toxicity Characteristic Leaching Procedure (TCLP) range from 254 to 1,677 ppm. Results are shown in the map below.

Figure 12: TCLP results, RAMCAR

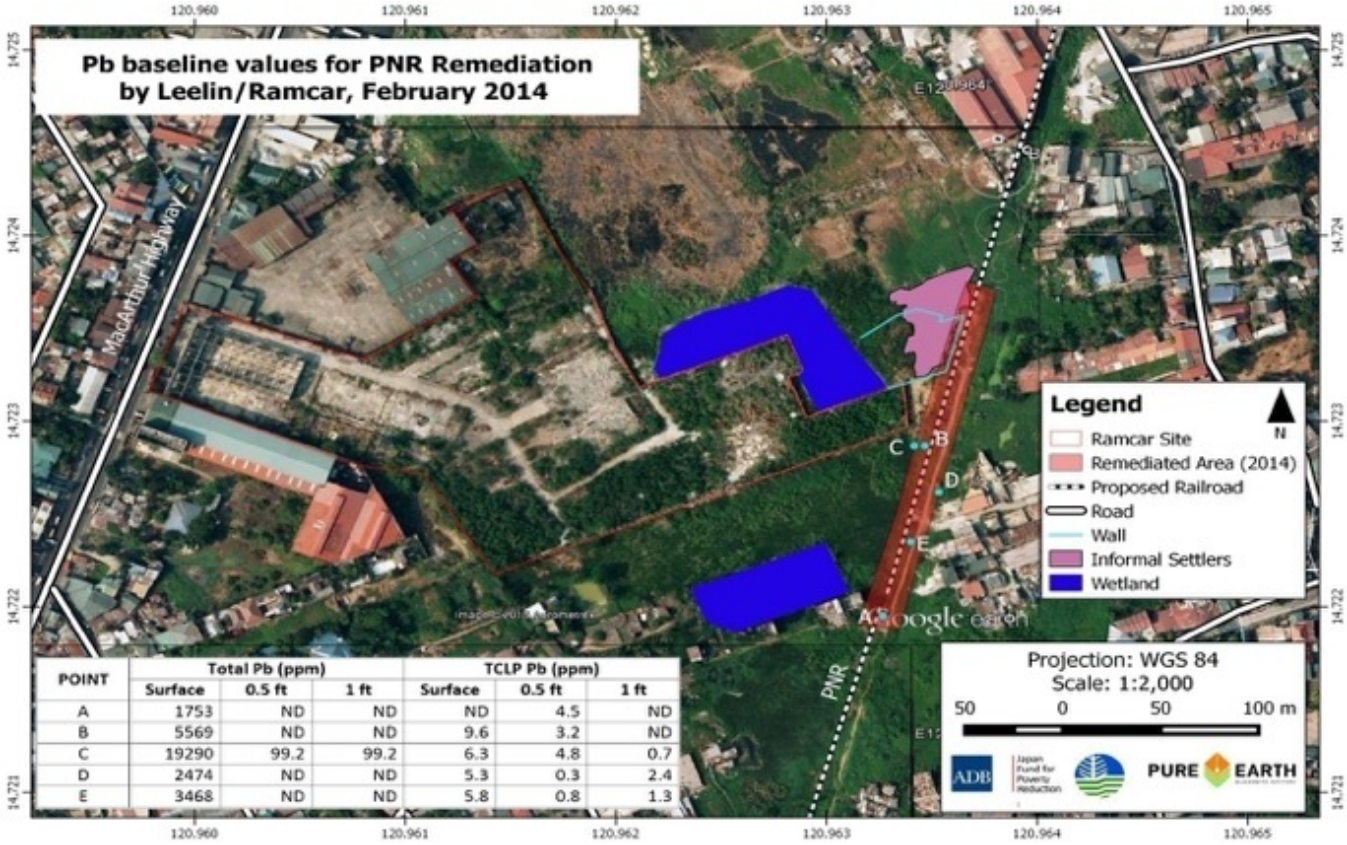


Date	Sample Identification	%Moisture	pH	Pb_{TCLP} (mg/L)	Pb_{TOTAL} (%)	As (%)
10-Jul-10	Meycauyan Soil Area 1	31	7	1,677	27	ND
10-Jul-10	Meycauyan Soil Area 2	24	9	1,181	22	0.353
10-Jul-10	Meycauyan Soil Area 3	27	8	1,008	30	0.35
10-Jul-10	Meycauyan Soil Area 4	19	8	459	11	0.713
12-Jul-10	Meycauyan Soil Area 5	16	8	643	4	0.441
12-Jul-10	Meycauyan Soil Area 6	18	8	622	8	ND
12-Jul-10	Meycauyan Soil Area 7	12	8	396	5	0.837
12-Jul-10	Meycauyan Soil Area 8	25	8	254	4	ND
14-Jul-10	Meycauyan Soil Area 9	16	7	1,485	28	ND
14-Jul-10	Meycauyan Soil Area 10	12	7	799	22	ND
14-Jul-10	Meycauyan Soil Area 11	20	7	696	23	ND
14-Jul-10	Meycauyan Soil Area 12	38	9	470	19	0.902
14-Jul-10	Meycauyan Soil Area 13	35	9	579	17	0.233
14-Jul-10	Meycauyan Soil Area 14	27	8	1,327	4	ND
14-Jul-10	Meycauyan Soil Area 15	40	8	770	12	ND
14-Jul-10	Meycauyan Soil Area 16	39	9	623	16	0.216

51. In 2010 the joint project accomplished the removal and proper disposal of battery plastic casings that had been used as house flooring and furniture by the informal settlers near the site. Remediation of the informal settlers' site was emphasized as an urgent course of action because there were children who were found to have blood lead levels (BLL) exceeding 10 ug/dL. Planned remediation of the area where the informal settlers live was not implemented however because the funds were not provided. It was also recommended that the interior of the site be remediated and initial discussions regarding the remediation options were undertaken. In 2014, within the context of the planned North Luzon Railway Project, RAMCAR, in coordination with EMB Region III and based on reconfirmed findings of the 2010 project, implemented remediation just outside of the walled property in the area owned by the North Luzon Railway Corporation (NLRC) property. The figure below shows the lead levels on soil surface at the railroad property adjacent to RAMCAR where

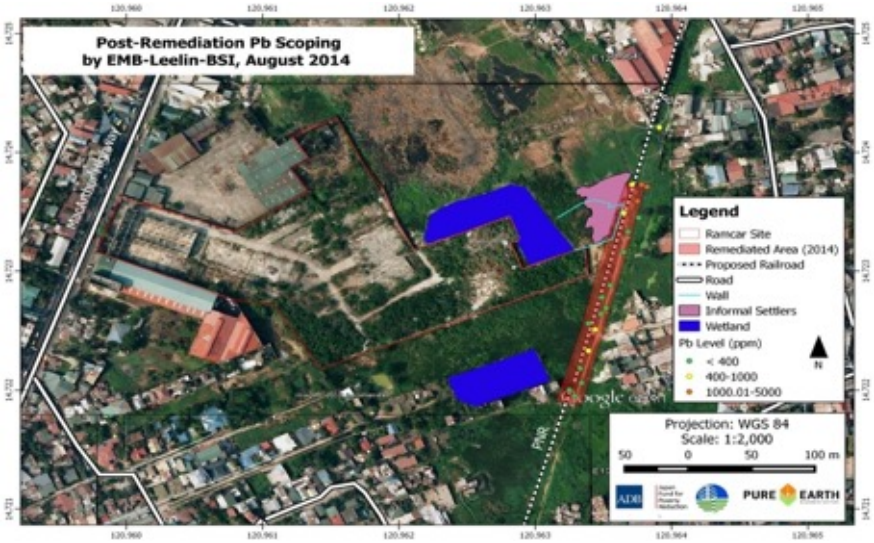
remediation was completed in July 2014. The total area excavated covered 3,800 sq. m. at 0.6 m depth with an estimated volume of 2,280 m^3. The contaminated soil was excavated and dumped inside the walls of the RAMCAR property. Clean soil was then used to backfill the site. Officers from DENR-EMB Region 3, Leelin Industrial Corporation and Blacksmith Institute conducted a post-assessment analysis in August 2014. Results of the post-assessment revealed that eight out of the twenty sampling points still had lead levels above 400 ppm. The range of lead levels above 400 ppm was 412.9 to 2540.56 ppm. These data are shown below in Figure 12.

Figure 13: Baseline Lead Levels



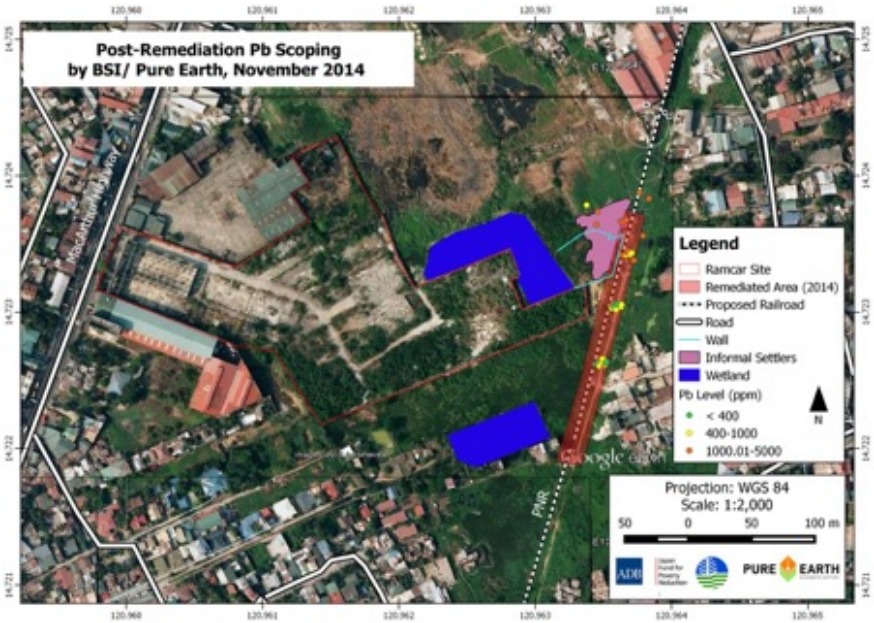
POINT	Total Pb (ppm)			TCLP Pb (ppm)		
	Surface	0.5 ft	1 ft	Surface	0.5 ft	1 ft
A	1753	ND	ND	ND	4.5	ND
B	5569	ND	ND	9.6	3.2	ND
C	19290	99.2	99.2	6.3	4.8	0.7
D	2474	ND	ND	5.3	0.3	2.4
E	3468	ND	ND	5.8	0.8	1.3

Figure 14: Post-Remediation Assessment



52. Under this TA, the area along the RAMCAR perimeter was reassessed in November 2014. Fourteen of the forty-four points exceeded the soil screening criteria for lead. Arsenic, cadmium and chromium also exceeded limits in some points. Sampling data is shown below.

Figure 15: Sampling Data



Exposure Pathways

53. Lead is the main contaminant at the RAMCAR site. The adverse health effects of lead include neurological impairment in children, neurobehavioral damage, and decrease in perceptual reasoning, working memory indices and processing speed indices. Lead is also associated with increased rates of cardiovascular disease and kidney damage in adults.

54. Based on interviews with local officials and community members, informal settlers in Daang Bakal (the community at the site of the railroad) who are residing outside the RAMCAR wall, retrieved lead slag and battery materials from inside the RAMCAR property. These materials were processed informally and sold to junkshops within the cities of Meycauayan and Valenzuela. Battery casings were also retrieved from the former facility and were used for flooring and construction. These activities spread lead dust and expose the community members via inhalation and ingestion of lead particles.

55. The Department of Health (DOH) and the University of the Philippines – National Poison and Management Control Center (UP-NPMCC) researched community exposure in Daang Bakal in 2010. Blood Lead Levels (BLL) of children living near the former ULAB site were analyzed in April and May 2010. Results showed that out of the 76 children ages 6-7 years, 12 had BLLs of more than 10 μg/dL, some as high as 65 μg/dL, the upper limit of detection for the Lead Care II analytical device. The United States Center for Disease Control (CDC) uses 5μg/dL as the level of concern for a child's BLL. At 45μg/dL, the CDC recommends treatment, typically chelation therapy.

56. Another toxicant, chromium (III and VI) was found in the area. Chromium, which is used in tanneries can expose a receptor through inhalation, dermal absorption or ingestion of contaminated soil, food and water. In 2014, three out of the 43 sampling points near the site exceeded the permissible chromium levels in soil for a residential area, which is 220 ppm. The highest reading was 1,110.53 ppm. The effects of hexavalent chromium include ulcers, asthma, chronic bronchitis, chronic rhinitis and chronic pharyngitis. It also produces allergic contact dermatitis and kidney or liver diseases among exposed workers. There are several tanneries in the area and one is located nearby the informal settlement area. It is possible that contamination from former operations has spread over the railroad and

informal settlement area through flooding or spillage. Further investigations must be completed to determine the extent and levels of concern of any potential chromium contamination.

57. In developing a remediation plan, it is important to take the following into account in planning the sampling method, locations, and protocols such as in the collection procedure, preservation, transport, and analyses of samples. (Source: Asante-Duah, 1996):

    - Water solubility (fate and transport in surface water and groundwater systems)
    - Dispersion/Diffusion (mobility, leachability, and biodegradation
    - Volatility
    - Cross-media transfers, bioaccumulation, and sorption by organic matter
    - The time it takes for degradation
    - Characteristics of the surrounding area particularly, historical and present moisture, humidity, temperature, and wind speed
    - Potential acute and chronic exposure through land use and anthropogenic activities
    - Socio-economic and health profile of the community, including dietary practices
    - Topography, climate-related, and geologic hazards of the area.

58. As part of the site investigation, the team reviewed the community poverty, economics, and health profile as well. The figure below outlines the key data collected by the team that may impact the exposures of the community.

Figure 16: Community Poverty, Economic, and Health Factors

Community Health Status Parameter	Key Findings	Relationship to hazardous waste contamination
Human/Biological	Children account for 50% of the population of Meycauayan	Children are vulnerable to the effects of hazardous wastes
	Majority of children in Meycauayan are well nourished.	Children will be able to combat diseases. However,

	However, 28.25% of children (0-7 years old) are malnourished.	there are also children who are vulnerable because of their nutritional status.
	Dietary preferences are vegetables and pork	Vegetables keep residents healthy. However pork increases the risk to cardiovascular diseases
	Lifestyle preferences: 29.4% of Tugatog residents are smokers and 39.3% drink alcoholic beverages	Smoking and alcohol affect almost all organ systems which, in turn, can affect a person's capacity to handle hazardous wastes; vices increase incidence of diseases
	Existing diseases: cardiovascular (hypertension) and respiratory (asthma)	Existing diseases increase risk to effects of hazardous wastes
	Causes of mortality: cardiovascular (#1) and cancer (#3)	A percentage of cardiovascular diseases and cancers is likely attributable to hazardous waste exposures
Social	Majority of residents have some level of education	Residents can have better understanding on adverse effects of hazardous wastes on health
	¼ of the residents in Tugatog and Bancal have income below poverty threshold; 82.6% of	The economic condition increases risk to toxic effects of hazardous wastes

	Tugatog respondents have salaries <Php 8,000/month	
	Majority of the residents are laborers and unskilled workers	Type of job exposes residents to effects of hazardous agents
Environment	Residents are exposed to physical (81.2%), biologic (77.2%) and chemical agents (70%)	The possibility of agent interactions increases the risk to illness
	Majority of residents have accessed to sanitary toilets and. Almost everybody are able to avail of safe water	These facilities protect person from exposure to hazardous substances
	Existing exposure sites (legacy ULABin Bancal; tannery plants in Tugatog) Presence of lead in biologic and environmental samples Trend of inverse relationship between blood lead levels of Bancal children and distance from the exposure site (ULAB) Trend of inverse relationship between blood lead levels of	The exposure pathway may be complete, increasing risk to development of disease

	Bancal children and IQ Poor working environment in the tannery factories (OSHC study)	
Medical/Technological/ Organizational/	Doctor : patient ratio is 1:24,894 Sixteen percent (16.4%) of Tugatog respondents identified unavailability of a doctor in the center as a problem when seeking consultation (2015 Tugatog survey)	Not all residents can avail of the services of a doctor. This can lead to environmental diseases not diagnosed at all and patients not provided with the appropriate treatment
	Fair utilization of government health services (5.4% among Tugatog residents, 28% among Bancal residents)	This increases the risk to development of illness
	Residents seek consultation only when they are sick (2015 Tagatog survey) Curative approach to health care is more favored than preventive care	This can lead to late diagnosis of environmentally-related illnesses which can have impact on clinical outcome and increase cost of health care
	Fair accessibility of health facilities since residents still need to secure money before visiting the centers (2015 Tagatog	This may exacerbtate illness

	survey)	
	Existing programs on solid waste management and drainage/flood control	If programs are effectively implemented, exposure to hazardous wastes is reduced.
	Lack of environmental program that focuses on chemical safety	This increases the risk to exposure of residents to hazardous wastes

59.

Figure 17: Household Reviews

Barangay	Population	HH	≤ 5 years old	Malnourished children (0-5 years old)	HH below the poverty threshold	HH below the food threshold	HH that are informal settlers	HH without access to improved water source
Bancal	14,242	2,663	1,520	12	737	332	36	224
Tugatog	4,288	1,144	665	0	255	114	10	52
Banga	2,911	629	400	4	205	332	5	251
Veinte Reales (Valenzuela City)	22,198	2,579	1,116	13	843	539	163	251

Total	43,639	7,015	3,701	29	2,040	1,317	214	778
Sources: PSA (2010) and CBMS (2005)								

Figure 18: Summary Health Data

Nature of Illness	Number	Percentage	Specific Illness
Cardiovascular	97	49.5	Myocardial infarction (48); Hypertension (36); Congestive heart failure (6)
Respiratory	34	17.3	PTB (17); Chronic obstructive lung disease (6); Pneumonia (3); Cancer (5)
Hematologic	17	8.7	Leukemia (5)
Eyes, ears, nose, throat	8	4.1	Cancer (4)
Reproductive	8	4.1	Breast cancer (3);Complication of pregnancy (1)
Neurologic	7	3.6	Stroke (7)
Gastrointestinal	7	3.6	Gallbladder stone (2); Cancer (1)
Genitourinary	6	3.1	Kidney disease (5)
Musculoskeletal	6	3.1	Cancer of the bone (3)
Endocrine Skin	3	1.5	Diabetes mellitus (3)
Skin	1	0.5	Psoriasis (1)
Psychiatric	0	0	

TOTAL	134	100.0	
Source: Household survey conducted in June 2015			

Remediation Alternatives

60. The team has identified 8 potential remedial alternatives for consideration:

- Excavation and off-site disposal at a toxic and hazardous waste landfill;
- Excavation and off-site stabilization and disposal (certified waste treater);
- Excavation and off-site encapsulation;
- Excavation and off-site solidification;
- Excavation and use in road-bed material or other solidification;
- Excavation and On-site encapsulation;
- Capping (on-site);
- Combination of methods depending on level of hazard and desired end use.

61. Because the plan is to redevelop the site, excavation in at least some areas will be required. The site is large and it is anticipated that the contamination levels will vary greatly between for example, areas that were formerly concrete floors of the buildings of RAMCAR and areas where slag was buried. Depending on redevelopment plans in various areas, different sections must be excavated, tested for contamination, and then dealt with appropriately and safely for the workers on site and the future residents or visitors to the site.

62. The most straightforward method of dealing with the contaminated materials is excavation and off-site disposal in a THW landfill. This alternative involves removal of the contaminated soils from the pilot site using conventional excavator and loader and transporting the same to an off-site landfill using dump trucks of a DENR-accredited waste transporter. The process would go through the waste transport manifest system prescribed by DAO 20014-36. Aside from the contact information of the waste generator, transporter and treater, the manifest or waste transport record will contain the following details:

- Class, sub-classification, and quantity of each hazardous waste;

- Type of container used during transport;
- Intended methods of hazardous wastes treatment, storage, recycling, reprocessing;
- or disposal at TSD facilities;
- Special Instructions.

63. The excavated area can then be backfilled with imported clean soil. This strategy is proven effective and is particularly favorable when maximum future use of the site is desired. The landfill owner ensures that the material is properly dealt with and the site owner is no longer responsible for any ongoing oversight regarding contaminated material.

64. In the case of the former ULAB recycling facility, the nearest and only toxic and hazardous waste landfill is the Metro Clark Waste Management Corp. Sanitary Landfill in Capas, Tarlac. Based on DAO 2004-36, it is classified as Category C TSD facility, which is a landfill that accepts hazardous waste for disposal or accepts only inert hazardous waste residues for final disposal.

65. Getting the materials to the Clark Hazardous Waste Landfill will entail excavation, loading, transport, gas, and tipping fees. It must be noted that there is a qualifier for the wastes this landfill accepts; it should be hazardous waste, “treated” with inorganic chemicals until it’s lead (Pb) concentration is less than 5 mg/L based on analysis of an extract (i.e., TCLP). This means that prior treatment should be done before the excavated Pb-contaminated soil can be disposed in this landfill if the soil TCLP shows lead levels greater than 5 mg/L. Cost therefore, not only of excavation, loading, transport, and tipping, but also of prior treatment is a major consideration for this remedial alternative.

66. A similar option for remediation is excavation and off-site stabilization and disposal. DAO 2004-36 defines stabilization as chemical immobilization of hazardous substances, through chemical bonds to an immobile matrix, or chemical conversion to immobile species, thereby reducing vaporization or leaching to the environment. It must be noted that this method may need to be performed before disposal at Clark as discussed above. The United States Environmental Protection Agency (USEPA) considers solidification/stabilization to be the Best Demonstrated Available Technology for non-wastewaters contaminated with leachable

chromium and lead (USEPA, 1997). A number of Category E TSD facilities are located in Region III, where the pilot site is under the same jurisdiction. DAO 2004-36 specifies that these are facilities that immobilize, encapsulate, polymerize or treat hazardous wastes off-site. Hence, this may be applicable when there is no landfill available to accept the contaminated soil. But Category E also includes those that receive hazardous waste outside the premises and transform physical and/or chemical characteristics of the hazardous waste by physicochemical or thermal treatment in order to dispose of them into the facilities in Category C. For instance, Dolomatrix (a Category E TSD) provided the methodology and cost for treating Pb-contaminated soil with chemical fixation and stabilization of waste using Dolocrete Technology. As with the first alternative of off-site disposal in a toxic hazardous waste landfill, the major consideration for this technology is cost.

Excavation and off-site disposal in an encapsulation structure.

67. DAO 2004-36 defines encapsulation as physical immobilization of hazardous substances in a waste by enveloping the waste in a non-porous, impermeable material. Immobilization will prevent water run-off from spreading the contaminant down to the groundwater or off-site into creeks and rivers.

68. This remedial alternative could be applied in any of the following scenarios: there is no existing THW landfill, there is a THW landfill but the transportation costs are too high, or there is a THW landfill but cannot accept contaminated soil that is not pre-treated, stabilized or solidified. Having a nearer disposal site can clearly lower transportation costs and having a remote encapsulation structure may remove from the equation the pre-treatment costs, which is also likely to be really expensive. However, still, it bears the cost of constructing an encapsulation structure, which requires standard landfill engineering.

69. This alternative will require a remote area that will be excavated and built to standard landfill design using appropriate capping material (i.e., clay, HDPE plastic liner, clean soil, asphalt or concrete) depending on the contamination levels of the soil to be disposed. Controls such as leachate detection, collection, and management systems shall be put in place. All contaminated soil will be taken to this containment area and capped.

70. DAO 2004-36 does not have specific provisions for encapsulation. However, it outlines the following minimum considerations for siting TSD facilities:

- Consistent with the overall land use plan of the LGU
- Accessible from major roadways and thoroughfares
- Located in area where the TSD operations will not detrimentally affect sensitive resources, such as aquifers, groundwater reservoir or watershed area, by provision of the following special mitigation measures and additional criteria:
- Shall not be constructed within 75 meters from a Holocene fault or known recent active fault
- Shall not be located in areas where they are known to be habitat of listed endangered species
- Shall not be located in a floodplain and/or reclaimed areas
- Shall be located at least 50 meters away from any perennial stream, lake or river
- Groundwater monitoring wells shall be placed at appropriate locations and depth for taking water samples that are representative of groundwater quality and for predicting groundwater flow
- A more detailed relevant guideline is that of landfills contained in Rule XIV of the Philippine Ecological Solid Waste Management Act of 2000 or RA 9003. Additional special mitigation measures specified herein are as follows:
- The site shall be evaluated for presence of geologic hazards, faults, unstable soils, its foundation stability, and its hydrogeologic character.
- It shall be provided with a composite base liner system consisting of a minimum 1.5 millimeter (mm) thick high density polyethylene liner (HDPE) underlain by a soil liner with a minimum thickness to 0.60 meter (m) and maximum permeability of 1x10-6 centimeter/second (cm/sec).
- A Geosynthetic Clay Liner (GCL) with a minimum thickness of 6.4 mm and permeability of 1x10-9 cm/sec or less, may be substituted for the soil liner. Likewise, the design of the final cap shall be equivalent to its liner system in terms of permeability. The thickness of the final cover system shall be at least 1.5 m including a minimum 0.60 m thick soil foundation layer, its final cap, a drainage layer, and a vegetative layer of at least 0.30 m thick. If the thickness of the equivalent final cap makes the entire cover system less than 1.5 m thick, the deficiency shall be made up by increasing the thickness of the foundation layer.

- Strict liner and final cap construction quality assurance (CQA) and testing shall be performed by a third party experienced in earthwork, clay and geosynthetic liner installation, quality assurance supervision, testing and inspection.
- A separation of at least two (2) meters shall also be maintained between the top of the liner system and underlying groundwater. It can be summed up that the major considerations for this remedial alternative are cost, site availability and suitability and regular monitoring and evaluation.

On-site encapsulation by building an encapsulation structure.

71. This alternative is basically the same as alternative C except that it will utilize part of the pilot site's total area to contain the contaminated soil. The "encapsulated area" will still have future uses but limited (i.e., parking). However, the cleaned area outside the encapsulation may have some construction or development. Given that there's an estimated 39,000 m^3 of contaminated soil, the at-source encapsulation would require a large portion of the pilot site. Additionally, the high groundwater levels and frequent flooding make on-site encapsulation infeasible.

Capping

72. This alternative involves constructing a cover over contaminated soil to minimize potential exposure to and contaminant migration. Typically, soil, asphalt or concrete is used. It is generally applicable to low-level contamination, when excavation and off-site disposal is not feasible, and when the desired future use has need for roads, parking spaces, building slab foundations, or other paved areas where the contaminated soil could be contained under. Capping prevents direct contact and exposure to windblown contaminated dust and rainwater infiltration. Even though lead is not very soluble, it could leach into groundwater and migrate to nearby streams/rivers. This could then be a risk to aquatic species and people who swim in the river, and/or eat contaminated fish.

73. Capping may also include a vegetative layer, a drainage layer, a geomembrane, or clay. When soil is used, ideally, a permeable barrier is placed in between the contaminated soil and the clean soil not only to inhibit contaminant migration but also to serve as a marker on how deep future digging can go. The design and material requirement would depend on

results of more in-depth assessment of the contamination levels and other critical factors like groundwater depth.

74. Capping is a more affordable alternative, has been a widely applied remedial alternative and has worked effectively in preventing environmental and human exposures. Limitations of this technology include long-term and regular cap maintenance and groundwater monitoring. The risks associated with this alternative relevant to environmental integrity are erosion and groundwater contamination due to infiltration. As such, this remedial alternative should be accompanied by drainage controls and an operations and maintenance (O&M) plan. Currently, shallow groundwater in the area is not pumped out and used for drinking, bathing, and cooking, so human exposure via pathways are not a concern. However, should future development require installation utilities in soil-impacted areas, this should be well taken into consideration. Also, it is best to employ stabilizing agents that will bind the contaminant to the soil and prevent it from being biologically available before capping.

75. This alternative requires periodic inspection and repair of the capping structure or material to ensure integrity, which would be described in the O&M plan. Further, a Soil Management Plan (SMP) should be developed, which describes procedures for proper handling of soil to prevent exposure of construction workers to contaminated soil in the case of future repair or construction beneath the capping (e.g., installation of underground utilities: water pipes, electrical lines, etc.). If soil beneath the caps are not cleaned up to residential standards, a “land use covenant” or “deed restriction” must be prepared and executed by the owner and local government authority. The purpose of this is if the land is sold in the future, the deed restriction states that subsurface contamination exists, and therefore, the property cannot be developed for residential use, and if developed, the soil would be managed properly, as described in the SMP.

76. Combination of off-site stabilization/disposal and capping. Depending on the level of economic and environmental considerations, combination of methods is often presented as another remedial alternative. For instance, in the case of the pilot site where completely off-site stabilization/disposal can be too expensive and where capping only proves to be risky

in terms of potential human and environmental exposure, combination may appear to be extra advantageous. “Hotpots” or areas of high contamination and areas where utilities and foundations will be built will be excavated and contaminated soil will be disposed in a THW landfill or sent to a treater that will do the stabilization and disposal. On the other hand, areas with low level contamination can be capped and used as parking or open space and roads.

GENERAL EVALUATION AND ANALYSIS OF REMEDIATION ALTERNATIVES

77. To provide a general review, evaluation and analysis of the above remediation alternatives for purposes of this preliminary discussion, the following considerations were applied:

    - Risk reduction effectiveness
    - Sustainability
    - Risks during the work
    - Community acceptance
    - Construction/project time
    - Logistical feasibility (space, getting materials/equipment to the site, geology, etc.)
    - Regulatory compliance
    - Conformance with internationally accepted practices

78. The tables below provide a general comparison of the possible remedial alternatives. The first table contains the results of the review and the second table contains the evaluation. Because each option received the highest possible marks for Risk Reduction and Compliance with International Standards, those columns were removed from this chart.

Figure 19: Remediation alternatives

	Alternative	Risk Reduction	Sustainability	Risks during Work	Community Acceptance	Construction Time	Logistical Feasibility	Regulatory Compliance	Cost	Advantage/ Disadvantage
1	Excavation and off-site disposal in THW landfill	Very high	Very high - no future O&M costs at site; depending on landfill capacity	Moderate – distance from source to landfill	Very high	4-6 mos	Moderate - High	Very high	Very high	Greatly reduced risk, maximized future site reuse
2	Excavation and off-site stabilization and disposal	Very high	Very high - no future O&M costs at site; depending on available stabilization technology	Moderate – distance from source to stabilization site	Very high	10-12 mos	High – Very high	Very high	Very high	Greatly reduced risk, maximized future site reuse
3	Excavation and off-site disposal in encapsulation structure	Very high	High - O&M costs to check and maintain the integrity of the encapsulation; depending on site availability and suitability	Moderate – distance from source to encapsulation site	Moderate to high – may have concerns over encapsulation integrity	10-12 months	Moderate - High	Moderate - High	Very high	Greatly reduced risk, maximized future site reuse
4	Encapsulation onsite ? structure at source	Very high	High - O&M costs to check and maintain the integrity of the encapsulation; depending on site availability and suitability	Moderate	Moderate to high – may have concerns over encapsulation integrity	10 – 12 months	Moderate - High	Moderate - High	Very high	Greatly reduced risk, may limit future site reuse
5	Capping	High	Moderate - O&M costs to check and maintain the integrity of capping and monitor groundwater	Moderate	Moderate– may have concerns over cap integrity	6-9 mos	High	Moderate	High	Reduced risk, limited future site reuse
6	Combination - Excavation and off-site stabilization/disposal and capping	High – Very high	High – Very high - O&M costs to check and maintain the integrity of capped portions and	Moderate	High – Very high – may have concerns over integrity of capped portions	5-8 mos	High – Very high	High	High to Very High	Greatly reduced risk, careful planning can still maximize future site reuse

			monitor groundwater							

Figure 20: Remediation alternatives

	Alternative	Overall Score	Sustainability	Risks during Work	Community Acceptance	Construction Time	Logistical Feasibility	Regulatory Compliance	*Cost	Community Advantage/Disadvantage
1	Excavation and off-site disposal in THW landfill	4.35	5	3	5	5	3.5	5	2	5
2	Excavation and off-site stabilization and disposal	4.05	5	3	5	3	4.5	5	0	5
3	Excavation and off-site disposal in encapsulation structure	3.65	4	3	3.5	3	3.5	3.5	1	5
4	Encapsulation structure at source	3.55	4	3	3.5	3	3.5	3.5	1	4
5	Capping	3.75	3	3	3	4.5	4	3	5	3
6	Combination - Excavation and off-site stabilization/disposal and capping		4.5	3	4.5	4.5	4.5	4		4.5

5- very good 4 – good 3 – moderate 2 – poor 1 – very poor 0 – unacceptable

**cost is given 0-5 scores with 0 being the highest cost and 5 being the lowest cost*

79. Based on this general technical evaluation, the favorable remedial alternatives at first pass are ranked as follows: 1) excavation and off-site disposal in a THW landfill; 2) excavation and off-site stabilization and disposal. These two are ideal however, the costs are too restrictive. The same can be said of the encapsulation options. Capping is affordable but may pose the greater human and environmental exposure risk. Hence, it is appropriate at this point to recommend a combination of remediation alternatives depending on the levels of contamination and the expected end use of each areas of the site.

80. A more comprehensive site assessment, particularly at the site of former operations and the suspected waste dump site, is required to put forth a final recommendation for remedial action. However, it is a must that remediation be undertaken seriously at the pilot site.

81. The remediation of the current informal settlers' area should be prioritized to eliminate the pathway and exposure to the families in the area especially where there are children. Also, it is necessary to reduce exposures during the railroad construction and operation.

KEY CONSIDERATIONS IN PURSUING REMEDIATION OF THE PILOT SITE

Environmental Considerations:

82. The proposed cleanup and remediation of the site will render a number of potential positive environmental impacts namely:

    - Mitigation of contamination
    - Mitigation of public health risks due to THW contamination
    - Control and mitigation of flooding must be addressed in the redevelopment plan
    - Strategic location for a redevelopment project with large investment opportunities
    - Generation of job opportunities due to redevelopment

- Success story on remediating and redeveloping legacy sites

83. On the other hand, the potential threats that must be mitigated if the site is developed are:

- Possible increase in traffic congestion
- Increased waste generation (need for solid waste and sewage management)
- Temporary disruption of operations for immediately adjacent commercial and industrial activities during contruction or remediation

Regulatory Considerations:

84. Baseline studies showed that while there are international and national legal instruments geared towards proper management of hazardous waste, local policies that support and strengthen the implementation of such up to the community level are minimal and lacking in infrastructure and training. The Bulacan Provincial Development and Physical Framework Plan, while providing the blueprint for development and some controls (i.e., flood and waste management), did not include reference to control of hazardous waste. In particular, the local government unit of Meycauayan, down to the specific Barangays of Bancal and Tugatog, does not have any local policy or program focused solely on THW management despite hosting several industries that utilize hazardous chemicals. In this context, the proposed clean-up and remediation will provide an opportunity for:

- Holistic planning perspective which will include THW considerations in local governance and development;
- Actual experience on toxic site identification, assessment, remediation and redevelopment;
- Developing and instituting local policies and programs on THW management, mitigation of THW contamination and public health risks, and redeveloping otherwise contaminated lands. In this particular case, a legacy lead contaminated site. Even the national government will benefit from this because there are no current laws pertaining specifically to remediation of lead contaminated sites including legacy sites;
- Increased tax generation when redevelopments investments materialize.

85. There are also regulatory barriers to consider in pursuing remediation and redevelopment:

- The current ambiguity over authority in remediation and redevelopment of the site, a contaminated privately owned land has created a stall in addressing this contaminated site. The government, both at national and local levels, has sufficient legal instruments to demand cleanup but has not been able to do this for various reasons. However, another option is now possible, presented by using a redevelopment approach, engaging a private developer who would be willing to clean up the site in order to gain a return on their investment. It may be easier to look at the project from a redevelopment perspective rather than just remediation because remediation is seen as a punishment or an imposed cost but redevelopment is seen with potential profits and benefits, a worthwhile investment.
- Lack of an incentives program for remediation and redevelopment projects has also been a barrier thus far but this can easily be changed. For instance in the New York State, there are tax credits available under the Brownfield Clean-up Program:
- Site Preparation and Onsite Groundwater Remediation - for remediation, demolition, excavation, fencing, security and other capital costs required to make the site usable for redevelopment: 25%
- Tangible Property Credit ("Redevelopment Credit") - for buildings and improvements placed in service within 10 years of Certificate of Completion: 10%
- Brownfield Opportunity Area (BOA) – for sites located within designated BOA: 2%

86. Another approach is for the government to shoulder the preliminary studies and development plan and then private sector can invest in the actual clean-up and development and still avail of incentives (using this project as a model). This requires the willingness of the private land owner/s to cooperate in the remediation and redevelopment initiative either by heeding the directive to remediate or by selling their property to or entering into a partnership with government or a private developer.

Social Considerations

87. Significant discussions with the primarily affected stakeholders, informal settlers and land owners were conducted in 2012 as part of the pilot project conducted in the area. There were follow-up discussions with the same and the rest of the community under this TA.

Informal settlers

88. Another challenge for this project is that relocation of the informal settlers needs to be thoroughly evaluated. A number of options would be: provision of opportunity to acquire low-cost housing as part of the redevelopment plan, within the site; provision of a nearby in-city relocation site; or provision of a relocation site elsewhere if the community is amenable. This discussion should be facilitated by the local government unit and the National Housing Authority (NHA).

89. In 2012, the main concerns of the informal settlers were as follows: where would they stay during the remediation work; can they be hired as laborers; if yes, how much would they be compensated; and permanently, where would they be relocated. During the 2014 site assessment and follow-up visits in 2015, the informal settlers claimed that they paid for their parcels but that it was not made official due to a conflict between the owners. These concerns must be settled by the local government unit and the NHA.

Land Owners

90. In 2012, Leelin's representative expressed that constructing a contained disposal site within the site seems to be the best option for remediation. However, this did not materialize and discussions ended. In 2015, Leelin was no longer willing to discuss remediation and redevelopment hence the lack of site access for actual assessment within the former facility. One other current owner was invited for project presentations and discussions but did not participate. Philippine Investments, one of the parcel owners, is fully supportive of the project but was limited by their own lack of access to the site. Family members related to the deceased owners of some of the sites are also willing to discuss the plans further. Complications around site access for investigators or government is understandable. It is one reason that a redevelopment rather than an environmental enforcement approach is preferred. The developers who are interested in making an offer for the site are more likely to be granted access or invited to a meeting than an environmental group looking to assess contamination.

Community

91. Community consultation was conducted with lot owners of the planned redevelopment site; school principals, hospital administrators, commercial building owners, along MacArthur highway; HOAs, and the Rotary Club. The consultation dwelt primarily on the preferred redevelopment option, the ideas of a pilot site, North and South side expansion, was selected for a mixture of commercial, institutional and residential development. Pursuing this development clearly requires prior remedial action in the pilot site.

Financial Considerations

92. The probable funding sources for the remediation are as follows:

93. Waste generator funding. In this case, the responsible party, Leelin/RAMCAR would shoulder the remediation cost. Leelin/RAMCAR may cite that guidelines and laws pertaining to hazardous waste generation, storage, treatment and disposal came after they have ended the Meycauayan operations and hence, do not hold them accountable. Also, they have changed their name and business several times since abandoning this property without properly cleaning it. However, despite non-operation, the legacy contaminated site they have left unremediated poses environmental and human health risks. The DENR EMB R3 and the LGU of Meycauayan, in accordance with their mandate to uphold environmental laws and constituency well-being, could require Leelin/RAMCAR to remediate. This was initially done in 2014 when DENR EMB R3 required Leelin/RAMCAR to clean up the contaminated areas which form part of the North Luzon Railway Corporation (NLRC) property.

Private land owners' funding

94. As per current records, the pilot site is divided into several plots with different owners. If these private land owners have intentions to either develop or sell the land, remediation should be addressed first. The project may be classified as environmentally critical given that the site is a legacy contaminated site and remediation itself is a project required to go through the Philippine Environmental Impact Statement (EIS) System. There are no current guidelines or laws espousing nor organized official records containing historical land use

description of titled properties to inform the due diligence transactions of would-be buyers. However, since the status of the site has been known to DENR EMB R3 and the LGU, the same should coordinate with the Land Registration Authority (LRA) to impose guidelines for the protection of would-be buyers. Depending on agreed arrangements, the land owners, the buyer or both may bear the remediation cost.

Developer or private sector funding

95. An interested developer may enter into negotiations with the private land owners for the acquisition of the site. Any planned development on the site will then go through the EIS and hence require remediation. For this option to prosper, a feasibility study should further research profitability and remediation costs. Several developers were consulted during this project to gain initial reactions to the plans and the site. When the redevelopment plans are complete, the government will be able to partner with the landowners to show the plans to potential developers and find an interested investor.

Public-private partnership funding.

96. This option is viable if the government (whether national or local) develops a program similar to the BOA where the government subsidizes preliminary studies and remediation – redevelopment planning and private sector makes an investment for the actual implementation.

Grant funding the remediation.

97. Grants for remediation are very limited. However, there is a current GEF UNDP project on "Reducing Environmental and Health Risks to Vulnerable Communities from Lead Contamination from Lead Paint and Recycling of Used Lead Acid Batteries" which is being implemented in Indonesia and the Philippines. In the case of the Philippines, the Executing Agency/Implementing Party, Blacksmith Institute, entered into a Memorandum of Agreement (MOA) with the DENR as the Responsible Party for the implementation of all project activities. This project has allotted $77,127 for pilot remediation of a Lead-contaminated site. The amount may not be sufficient to cover all costs but is significant enough to explore initial remediation or counterpart funding for complete remediation.

REMEDIATION COSTS

98. The team estimated the price per cubic meter for each of the 6 remediation alternatives as follows:

- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health, then transport it to the hazardous waste landfill – 1800 PHP/ m^3 ($37 USD/$m^3$)
- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health then stabilize it and dispose – 48000 PHP/m^3 ($1,000 USD/$m^3$) based on a quote from Dolomatrix; a local hazardous waste certified stabilization and disposal company. The quote included stabilization only)
- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health and then encapsulate or entomb off-site – 3200 PHP/m^3 ($66 USD/ m^3) (exclusive of price for purchasing the encapsulation/entombment site if required))
- Excavate contaminated soil that will be disturbed as part of the construction process or that would be a risk to human health and then encapsulate on site – 2700 PHP/ m^3
- Capping contaminated soil that would be a risk to human health, grading, covering with a liner, adding clean fill on top, instituting controls to manage future land use and prevent someone from penetrating the barrier – 1200 PHP/ m^3
- Combination of methods – transport some of the material to the hazardous waste landfill, cap or pave some surfaces, stabilize some materials. Cost depends on developer's decisions. This is the recommended remediation option as the costs can be managed by developing the site so that the highest contamination spots are paved to not come into contact with future residents or customers (cemented under a parking lot and roadways on the site for example)

ALTERNATIVE LIVELIHOODS

99. Because the pilot site is a legacy site and no livelihoods will be disrupted by the redevelopment, the team identified other informal workers in the surrounding barangays with the approval of ADB. The team worked with waste pickers at the local dumpsites (both shortlisted for the pilot project) and the residents of the informal settlement at the back of the RAMCAR site along the railroad right-of-way.

100. The informal waste pickers have an average weekly income of 300 to 2,300 PHP ($6-47 USD). Most of them have been collecting and selling recyclables like paper, cartons, PET bottles, tires, cans, and copper found in the dumpsite. To best understand the economics of the current livelihoods and the possibilities of developing new livelihoods for these groups, the team arranged several workshops with informal workers. A partner organization was identified to work with the stakeholders who would like job training and microfinance opportunities. Kabalikat sa Mauniad na Buhay, based in Valenzuela, has agreed to work with the local government and stakeholders to support the waste pickers and informal settlers in learning required job skills and identifying potential opportunities for employment. Providing these workers with business skills and access to capital can build on their experience in recycling and make it more profitable and formalized. The local partner organization and existing government programs will support these goals going forward.

REDEVELOPMENT PLANS

101. As part of this TA, the project team worked with local and international experts in redevelopment at contaminated sites. The team reviewed local strengths and potential, current population trends, and existing housing and retail developments in the area. The team researched the technical, environmental, legal, economic and social aspects of the site, considered its likely contamination level and required remediation and researched its potential for redevelopment.

102. After compiling data, interviewing local stakeholders, and working closely with the local community and government, the team collaborated on a redevelopment vision for the

RAMCAR site. The full strategic urban redevelopment plan is included with this report as Appendix G. the key components of that plan are highlighted below.

Size and Location

103. The size and location of the former RAMCAR site make it very desirable for development. There are many other successful developments in the area – businesses, housing developments, shopping centers, and schools. The site has limited frontage on MacArthur Avenue, which is a large thoroughfare, and is within walking distance of several colleges, a medical center, and several retail and food establishments.

104. The site is bordered by two fairly empty, large lots that if added to the plans would expand the site to 14 hectares and provide ample additional MacArthur Boulevard access. The figure below shows this expanded site option (with the initial site in gray and the expansion lots in blue and yellow.

Figure 21: North and South Expansion

SWOT Analysis (Strengths, Weaknesses, Opportunities, Threats)

105. The team also did a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis.

Strengths:

106. Skilled workers located nearby (jewelry, gold, tanning); several trade organizations located nearby (the Tannery Association of the Philippines, the Jewelry Association of the Philippines); Good competition with existing strong businesses, strategic location for Metro Manila outgrowth, commuters, transportation, and local business.

Weaknesses:

107. Declining business in some industries (leather and jewelry), a need to upgrade technology and skills among the local employee base, slow political action to ensure industry compliance with environmental regulations, little industry compliance with environmental standards, and high acquisition costs of land.

Opportunities:

108. very accessible location, incentives for compliance could develop with local government, branding of products is already recognized, there is not a lot of affordable housing so if offered it could be quite popular, there is an opportunity for instituting flood controls that would benefit the whole area.

Threats:

109. that must be addressed in the area are frequent flooding, high levels of contamination, traffic issues, and few waste management systems in place. All of these issues could be incorporated into the redevelopment project in some way to combat flooding, reduce contamination, manage traffic flows, and create a plan for waste collection and disposal.

110. In addressing these strengths and opportunities and managing for the weaknesses and threats, the team proposed the following:

- Expanding the site by including the north and south parcels to allow for more frontage along the main thoroughfare

- A phased development so that a Master Plan is followed, roads and utility systems are developed, the mall and BPOs are established early on as activators to draw others in, other BPO blocks and housing are built later based on demand
- Include a multi-story commercial building along MacArthur Avenue to capitalize on the location and generate significant rents based on office space availability in the area
- Construct residential areas at the back and north of the site because direct access to the main thoroughfare is less important
- Include institutional or office space at the southern part of the site to generate rents
- Include open space to suit preferences of the local community and draw people inside the development
- Include a tricycle terminal and new entrance along Bancal extension to facilitate traffic flow.

111. Details of the plan are included in the figure below in figure 21

Figure 22: Development Options, RAMCAR site

	Description	Estimated Area (sqm)	Building Construction Cost (Pesos/sqm)*	Other details/ examples
Commercial		***12,390***	278,775,000	
1st FLOOR	Leather products showroom	500	23,800 - 27,100	Will showcase products of environmentally compliant tanners and jewelry makers.
1st FLOOR	Jewelry showroom	250	23,800 - 27,100	Could also cater other small/medium scale tanneries and jewelry makers outside Meycauayan
1st FLOOR	Restaurants/ Stores	3,380	23,800 - 27,100	
2nd FLOOR	Out-of-town shopping centre, ave. standard	***4,130***	23,800 - 27,100	Supermarket, Wholesale and retail stores
3rd FLOOR	Medium/high rise offices, average	***4,130***	23,800 - 27,100	Printing, publishing plants and offices; engraving, photo developing and printing

*Construction Cost Handbook Philippines 2016

Description	Total surface area (sqm)	Est Building Construction Cost (Pesos/sqm)	Other details/ examples
Residential	***56,021.20***	335,016,400	
Apartment Tyoe/ High Density	7,321	27,000 - 34,000	Maximum 3 floors
Low Density	32,025	16,800 - 17,300	Considerations include flooding and additional cost from excavating the contaminated soil
Low Cost	3,490	10,200 - 12,500	Area equivalent to half of the residential bldg. on the north side. Maximum 3 storeys.
Institutional/ Office	***19,404***	2,008,808,860	
Option 1: Medium rise offices, average standard		25,000 - 27,500	Government Office Center (SSS, NBI, Pag-ibig, PhilHealth), banks/ BPO
Option 2: School		19,500 - 22,200	Primary school
Open Space/ Park	***53,804***		Includes an outdoor museum/exhibit of the history of the tannery and jewelry industry in Meycauayan/ manufacturing process
Roads/ Utilities	***36,413***		

112. Illustrations of the type of development recommended for the site were presented at the community feedback meetings to allow attendees to see what the development could look like and inspire feedback. Some of those images are below.

Figure 23: Renderings, Development Site

Residential

Government Office Center

Open Space/ Park/ Outdoor Museum

Parking

DEVELOPMENT COSTS

113. The proposed project is comprised of three different income generating land uses – commercial rents (20% of the site), institutional rents (10% of the site), and housing sales (40% of the site). The project will require acquisition of the land. In order to estimate costs of buying the land, current market values were used. The total costs to purchase the land are estimated at 150,056,786 PHP ($3,105,409 USD). The details are included in the figures below. The development costs to construct the roads, utilities, and open spaces were estimated using the Construction Cost Handbook, Philippines 2016 by Langdon & Seah (www.LangdonSeah.com). The total estimated development costs were estimated to be about 1,000 PHP ($21 USD) per square meter. This includes the costs of remediation. Total development costs are 125,047,321 PHP ($2,587,840 USD).

Figure 24: Land Values and Effective Costs

LAND VALUES
BASED ON TAX DECLARATION

LOT NO.	LOCATION	CLASSIFICATION	AREA (SQM	PRICE PER SQM	MARKET VALUE	SITE
5-A-1-B-3		Industrial	2	1,200,000	2,736,000	Ramcar
5-A-1-B-3 & 2-B-2-C		Industrial	2,760	1,200	3,312,000	Ramcar
5-A-1-B-2		Industrial	977	1,200	1,172,400	Ramcar
2-B-1		Industrial	2,795	1,200	3,354,000	Ramcar
2-A	Bancal, Meycauayan, Bulacan	Industrial	3,752	1,200	4,502,400	Ramcar
3-A-2	Bancal, Meycauayan, Bulacan	Industrial	9,789	1,200	11,746,800	Ramcar
6-A-I-A	Bancal, Meycauayan, Bulacan	Industrial	571	1,200	685,200	Ramcar
724	Bancal, Meycauayan, Bulacan	Industrial	4,291	1,200	5,149,200	Ramcar
730	Bancal, Meycauayan, Bulacan	Industrial	4,070	420	1,709,400	Ramcar
5097	Tugatog, Meycauayan, Bulacar	Industrial	4,066	420	1,707,720	Ramcar
731	Tugatog, Meycauayan, Bulacar	Industrial	6,368	1,200	7,641,600	Ramcar
732	Tugatog, Meycauayan, Bulacar	Industrial	5,903	1,200	7,083,600	Ramcar
7	Tugatog, Meycauayan, Bulacar	Industrial	4,055	420	1,703,100	Ramcar
13			49,399	1,063	52,503,420	

LAND COST & ALLOCATION

#	LAND USE	AREA	COST / SQM (W/ VAT)	COST / SQM (W/O VAT)	TOTAL COST	ALLOCATION OF NON-SALEABLE LAND COST	TOTAL COST	EFFECTIVE COST / SQM
1	**Saleable**	**98,037**	**1,200**	**1,071**	**105,039,750**	**45,017,036**	**150,056,786**	**1,531**
	Commercial	28,011	1,200	1,071	30,011,357	12,862,010	42,873,367	1,531
	Institutional	14,005	1,200	1,071	15,005,679	6,431,005	21,436,684	1,531
	Housing	56,021	1,200	1,071	60,022,714	25,724,020	85,746,735	1,531
2	**Non-Saleable**	**42,016**	**1,200**	**1,071**	**45,017,036**	**-**	**-**	**0**
	Open Space / Parks	14,005	1,200	1,071	15,005,679	-	-	0
	Roads / Utilities	28,011	1,200	1,071	30,011,357	-	-	0
	TOTAL	**140,053**	**1,200**	**1,071**	**150,056,786**	**45,017,036**	**150,056,786**	**1,531**

Figure 25: Total Development Costs

#	LAND USE	AREA	COST / SQM (W/ VAT)	COST / SQM (W/O VAT)	TOTAL COST	ALLOCATION OF NON-SALEABLE LAND COST	TOTAL COST	EFFECTIVE COST / SQM
1	**Saleable**	**98,037**	**1,000**	**893**	**87,533,125**	**37,514,196**	**125,047,321**	**1,276**
	Commercial	28,011	1,000	893	25,009,464	10,718,342	35,727,806	1,276
	Institutional	14,005	1,000	893	12,504,732	5,359,171	17,863,903	1,276
	Housing	56,021	1,000	893	50,018,929	21,436,684	71,455,612	1,276
2	**Non-Saleable**	**42,016**	**1,000**	**893**	**37,514,196**	**-**	**-**	**0**
	Open Space / Parks	14,005	1,000	893	12,504,732	-	-	0
	Roads / Utilities	28,011	1,000	893	25,009,464	-	-	0
	TOTAL	**140,053**	**1,000**	**893**	**125,047,321**	**37,514,196**	**125,047,321**	**1,276**

REVENUE GENERATION

114. The detailed economic analysis for the redevelopment plan is included in Appendix G. Overall the development is expected to generate revenues through housing sales and commercial or business rents. While there are upfront costs of remediation, construction, and then ongoing maintenance, it is expected that the net income after taxes would be enough to pay back to the development costs within 10 years.

115. The redevelopment plan could accommodate fourteen low-rise apartment buildings with a total of 1,195 units with an initial average selling price of 65,000 PHP ($1345 USD)per square meters and a unit price of 2,184,000 PHP ($45,198 USD). There could also be about 294 duplex units with an average size of 100 square meters to cater to growing families. The initial average selling price for those units is suggested to be 52,000 PHP

($1076 USD) per square meter with a unit price of 5,824,000 PHP ($120,527 USD). The total sales from apartments and houses would generate about 3,800,000,000 PHP (78,640,582 USD). The development costs for the housing would be 2,200,000,000 PHP ($45,528,758 USD). Operating expenses projected for the apartments and houses are calculated at 16% on average. Therefore, the net income after tax that is projected for the housing portion of the development is 692,300,000 PHP ($14,327,072 USD).

116. In addition to housing, the plan includes commercial space. The vision for the site is a lifestyle mall that can provide shopping, dining, and entertainment opportunities. Additionally, BPO and IT offices could be included to provide alternative workplaces that would allow residents to stay in Meycauayan who normally commute elsewhere to work. Finally, a government center could be included in the development, providing a new, accessible, technologically advanced location for government services that would be easily accessible to the public and officials.

117. The plan sets aside 2.8 hectares for the commercial space with a total leasable area of approximately 39,200 square meters. The initial basic rental per unit is projected at a minimum at 31,884 PHP ($660 USD) per month. The office space component of the project is comprised of five buildings with 5 floors of boutique space for BPO and IT companies with ground level retail – coffee shops, banks, fast food, and /or government offices. The space could accommodate a maximum of 100 tenants with an average unit size of 392 square meters and an initial average lease rate of 787,000 PHP ($16287 USD) per square meter. Taking development and operating costs into account, the net income projected for the commercial and office spaces over a 25-year period is 8,300,000,000 PHP ($171,767,587 USD). This means that within 10 years, the remediation and redevelopment costs would be completely paid back.

FUNDING MECHANISMS

118. There are potential institutional arrangements that could make a redevelopment opportunity at the pilot site even more attractive. In the capacity building workshops with the government, the TA team presented case studies of institutional arrangements that have been implemented in other countries to support redevelopment at contaminated sites. These are successful examples of improving the return on investment for developers and are typically very low cost or low effort for local government. A strong recommendation for the Philippines site is to consider public-private partnership, which would increase the return on investment above what is estimated in the redevelopment plan. Specifically, some form of tax relief or tax moratorium could improve net income after taxes, forming the "public" side of a partnership. This would be a desirable benefit for a developer who in return is willing to pay for remediation and redevelopment of the site, increasing business prospects in Meycauayan, attracting jobs, providing affordable housing, and bringing new business prospects and tax payers to the area.

119. Another funding mechanism that is recommended for consideration is the inclusion of equity partners. One or more "private" land owners could be included in the development. These land owners (such as the Origen family who own property bordering the site) could contribute some or all of the value of their land to a development partnership in which they would receive a portion of the Net Income After Tax (NIAT) based on the value of their land as proportion of the total development cost. This could provide equity to secure long term financing and improve the return on investment for development.

120. While institutional arrangements are suggested and would be an interesting way for the government to encourage development, the team does not believe that institutional arrangements are required for the success of the project. Given the many successful developments in the areas surrounding the site, the access to capital and the market for buyers seems very likely. Overall, there are very good prospects for the former RAMCAR site if it is remediated rather than sitting underutilized and contaminated.

ACTION PLAN FOR IMPLEMENTATION

121. The Technical Working Group, the stakeholder group that was established to support this project, will also support the implementation of the desired activities of the local and national government related to the recommendations of the TA. The local and national government representatives who made up the Technical Working Group will take the lead on the remediation and redevelopment of the former RAMCAR site if they so desire. They have been supportive of all of the work under this TA to date and their involvement will be required for the site to become something productive and safe. While there is some underlying hesitancy in getting involved at the contaminates site, the health risks faced by the local residents if the site is left polluted will likely lead to action on the part of the government. The key next steps as recommended by the team and discussed by the stakeholders at the final meeting are:

122. Persuade RAMCAR or other owners to allow access to the site to determine the extent of contamination and prepare more complete remediation estimates if possible. If this is not feasible, the project still can move forward and interested developers could ask for access. As mentioned previously, there is more likely to be cooperation when a potential investor gets involved with government support.

123. Meet with potential developers to show them the possibilities of the site and identify interested investors. This may require government incentives to complete a contract. Pure Earth has committed to participating in these meetings if the local government so desires.

124. Community education and clean-up as part of the remediation process and to protect residents from further exposures to hazardous materials. Pure Earth has provided templates and education materials on the project website that can be modified by local government or a hired consultant undertaking an education and health campaign.

125. Strengthen enforcement capabilities at the barangay level particularly in environmental monitoring and protection

126. Establish a Toxicology Center in Region 3 to research and collect data, hold education and training sessions, and maintain open access data for government agencies and local, regional, and national stakeholders

127. If desired, develop a program to support other redevelopment programs of other contaminated sites nationally and conduct a local inventory of contaminated sites in order to create additional potential redevelopment projects that can improve otherwise unproductive, under-utilized land. Pure Earth will continue to offer access to its Toxic Sites Identification Program site screening trainings to any interested government agency.

128. Find a safe, agreed upon location for the informal settlers who will need to relocated from the back of the site and the railroad right-of-way. These people are currently exposed to high levels of lead.

129. Support the alternative livelihoods work with the interested residents in the surrounding barangays through education and business training. These efforts will also be supported by the Alternative Livelihoods partner on the TA - Kabalikat sa Mauniad na Buhay.

ADB

Japan Fund for Poverty Reduction

JAPAN
Official Development Assistance

Ministry of Environment and Forestry,
The Republic of Indonesa

Department of Environment
and Natural Resources,
The Government of The Phlippines

PURE EARTH
BLACKSMITH INSTITUTE

Strategic Redevelopment Planning

Indonesia

Chapter 4

Chapter 4

Strategic Urban Redevelopment Planning, Indonesia

Table of Contents

CHAPTER SUMMARY

1. This is chapter four of the Final Report for The Technical Assistance Project: Mitigation of Hazardous Waste Contamination in Urban Areas: Supporting Inclusive Growth, TA8458. Other chapters in this report address the challenges of hazardous waste management and redevelopment of contaminated sites more generally and provide recommendations from the project team toward inclusive development, hazardous waste management, and remediation and redevelopment for a contaminated site. This chapter describes the pilot demonstration conducted in Indonesia including and covers the following themes: the site selection process; baseline studies; development potential of the area; remediation needs; and the action plans for implementation at each site.

Site Selection

2. The site selection process for a pilot demonstration area in Indonesia began with a review of preliminary data in the Pure Earth Toxic Sites Identification Program (TSIP) database. Four candidate sites were selected for detailed review. The four sites were shortlisted based on previously collected baseline data, information regarding the Indonesian ULAB supply chain, and priorities of the Ministry of Environment and Forestry. The national and international TA consultant teams further evaluated the shortlisted sites in order to nominate one pilot site. The pilot site would be the target for both an intervention that mitigates the human health risks from hazardous waste contamination and a strategic urban development plan. The proposed sites were:

    - Tangerang Regency
    - Bogor Regency
    - Tegal Regency
    - Lamongang Regency

3. Each site was visited between February 4 and 5, 2015. The local government of each shortlisted location was asked to provide information in response to a series of questions concerning key parameters of project success and local government commitment, especially with regard to:

    - Planning and budgeting for waste management and recovery of contaminated lands
    - Policy and enforcement of environmental standards
    - Promoting alternative livelihoods
    - Providing areas for relocation of hazardous waste processing
    - Inclusion of hazardous waste and remediation in spatial planning

4. In addition, the TA implementing team heard from national and provincial officials regarding policy and the current status of hazardous waste mitigation within their jurisdictions at the Inception Workshop held on February 3, 2015. Representatives from each Bogor, Tegal and Lamongan Regencies were present.

5. Municipal officials later accompanied the project team on field visits to sites in Bogor and Tegal. The project team met with environmental officials from the City of Tegal to discuss policies, plans and actions. Among these plans was the relocation of several informal smelters from residential neighborhoods to a designated industrial zone, the Perkampungan Industri Kecil (PIK-Kebasen), located outside of the residential areas.

6. International land use and economic consultants developed criteria based on factors that lend to successful urban redevelopment. The criteria allowed for strategic evaluation for the redevelopment potential of candidate sites. The criteria, which were presented and discussed at the Inception Workshop, focused the evaluation on the following four principal factors that are intrinsic to redevelopment in urban areas:

    - Physical characteristics of the site
    - Socioeconomic characteristics of the population, business and industry and fiscal considerations that may influence investment decisions
    - Policy (national, provincial and municipal) regarding hazardous waste
    - Land use patterns and regulations that permit or constrain development, particularly with regard to open space

7. A matrix was developed to rate how well each site met 17 criteria on a sliding scale of 0 to 4. A score of 0 indicated that site characteristic would greatly constrain redevelopment and a 4 indicated that the site would substantially meet the criteria and strongly support redevelopment. Not all criteria are equally important to the redevelopment potential of a site, so the criteria themselves are weighted 1, 2 or 3 with 1 being the least important and 3 being the most important. The score for each criterion is calculated by multiplying the criterion rating by the importance of the criterion. The 17 scores for each site were summed to provide an overall evaluation for each site. The analysis below highlights the redevelopment potential of each site from a land-use and urban planning viewpoint.

ASSESSED SITES

Site One: Informal Smelter, Bogor (backyard smelter site)

8. Site 1 contains an informal backyard smelting operation in a residential neighborhood in the suburbs of Bogor. Although the site is active and poses an environmental danger and public health threat to the owner, his family and his neighbors, the operation is very small and offers little opportunity for redevelopment. If the smelting operation were either removed or relocated, the site could be cleaned and could serve either as open space for the existing home or as another residential home site, depending on the local zoning.

Figure 1: Manual slag separation for lead recovery at Bogor

9. This site had the second highest score in the evaluation matrix, with a total of 51 out of a maximum of 124, tied with another informal smelting site in the Bogor suburbs. Despite the limitation on redevelopment because of its small size, the closing and removal of the informal smelter would undoubtedly improve neighborhood character and have a beneficial impact on surrounding land values.

Site Two: Informal Smelter, Bogor (fishpond site)

10. Site 2 contains an informal smelter next to a small fishpond. The informal smelting operation is reasonably isolated from residential areas, which while a benefit to local environmental conditions, limits its redevelopment potential. A narrow bridge and roadway lead to the site, making access difficult. In addition, as noted in the attached evaluation matrix, redevelopment potential is further limited by the small size and configuration of the site. As a

result, Site 2 scored the lowest among the four sites observed (three in the Bogor area and one in Tegal) in terms of its potential for the type of redevelopment that would benefit the local economy or the land use characteristics of the area. Rating all 17 criteria used to evaluate potential impact on land use and urban development, Site 2 scored only 35 out of a maximum score of 124.

Figure 2: Informal Site at Bogor (Fishpond)

11. Despite the low score, the site could be used to expand the existing fishpond operation if the smelter was removed and the land suitably remediated, depending of course on market demand and zoning regulations.

Site Three: Informal Smelter, Bogor (Hillside Site)

12. Site 3 is the largest of the three informal smelting operations evaluated in the City of Bogor. Up to three smelters are scattered across the site, but because of a radical change in topography only one is located adjacent to residential and commercial activity in the neighborhood. The other two smelting operations are somewhat isolated, hidden by trees and undergrowth in a broad valley substantially below the residential and commercial area. Removing and rehabilitating the site of the smelter adjacent to the residential and commercial area would clearly benefit neighborhood character and property values, as well as environmental conditions and public health. However, on its own, this portion of the site is too small to offer substantial redevelopment opportunities greater than the addition of a residence or commercial building. Economic benefits are therefore limited.

Figure 3: Bogor hillside site

13. The larger portion of site is located at the base of a narrow road approximately 10 to 15 meters below the residential and commercial area. Here the site is a broad flat plain surrounded by wooded hills and dense undergrowth, bounded on one side by a running creek. Because of its relative isolation, this portion of the site could be used to consolidate smelting operations, with the lower elevation and dense tree canopy providing a buffer to residential land uses from emissions and other smelting processes. Of course, it is assumed for this evaluation that any reconfigured smelting operation would meet the latest standards and regulations of the municipal, provincial and national governments, and would employ the latest industry technologies for clean smelting.

14. Consolidation of smelting activities in this valley would make the upper portion of the site available for redevelopment. Its proximity to the adjacent residential and commercial district could create several opportunities for alternative land uses, including the fabrication and sale of safe byproducts from ULAB operations. Alternatively, the upper portion of the site could be redeveloped with a limited number of residential and/or commercial uses.

15. It was noted by several members of the project team that local zoning regulations would likely prohibit the consolidation of smelting operations, as would local public policy aimed at closing smelters instead of allowing them to expand. Nonetheless economic benefits could be generated by these alternative land uses, including expansion of the workforce, increase in property taxes and property values, and general improvement in local business climate,

all of which might warrant reconsideration of zoning regulations and discussions with municipal officials. Based on the evaluation criteria relative to size and configuration of the site, economic benefits, improving neighborhood character and proximate sites available for new development, Site 2 scored 53 out of a maximum of 124 points in the evaluation matrix, the second highest of the four sites evaluated for land use and redevelopment potential.

Site Four: Waste dump and informal smelters, Tegal

Figures 4 and 5: Tegal

16. Site 4 is a large informal smelting operation set in a waste dumpsite in the midst of a residential and commercial neighborhood in the City of Tegal. The site contains multiple smelters in several buildings with at least two unsanctioned emission stacks, and several fire pits and slag heaps. Smelting here includes recycling ULAB materials as well as other metals such as aluminum. A metal fabricator also operates in a small building on the site. Most of the land is covered with contaminated residue from smelting. In addition, large piles of household garbage litter the site, one of which was burning during the site visit.

17. The most urgent need for remediation of hazardous waste contamination is found immediately offsite in several residences that are home to families with young children. No barriers were observed to separate and protect the children from the smelting operations. The broader neighborhood surrounding the site is a mix of residential, commercial, educational, cultural and light industrial activity. Several more modern residences are located near Site 4, as are a few retail stores, a middle school and high school. Several machine shops and metal fabricators are also located close to the site, as well as a metal salvaging business.

18. The site's entrance breaks the continuity of the buildings on the adjacent main street, which is evidence that one or more buildings were demolished to permit easier access to and from the smelting operations. In considering urban development opportunities, perhaps the most important land use abutting Site 4 is the site of the tomb of Amankurat I, the sultan of Mataram from 1646 to 1677. This cultural site attracts more than 10,000 tourists per year and is immediately adjacent to a mosque and large public open space whose entry is busy with vendors selling food and tourist trinkets. A residential district is also adjacent to the tomb, mosque and Site 4.

19. Finally, based on presentations and discussions during the Inception Workshop and the meeting with some of the city's environmental officials it seems reasonable to think that local public policy would support the closing and removal of the remaining informal smelting operations on Site 4.

Figure 6: Paver brick forming in the PIK

20. The probability that this could happen is improved by the presence of an industrial center located in an area that is a substantial distance from residential neighborhoods. This center, called Perkampungan Industri Kecil (PIK), already contains a number of smelters as well as materials handling and fabrication of by-products from ULAB recycling such as paving blocks and from other metal recycling such as decorative sculptures.

21. Overall, Site 4 received the highest rating as a redevelopment site, scoring 94 out of a possible 124 points.

22. The shortlist was narrowed to two candidate sites upon completion of all site contamination, government priority, development and economic evaluations: Tangerang and Tegal. This recommendation was formalized in a letter and submitted to the Ministry of Environment and Forestry of the Government of Indonesia. The team ultimately ranked Tegal District higher because of the government's planned remediation efforts there, the relocation of some the smelters into an industrial zone that has already been constructed, with the possibility of more being moved, and the short timeframe of the project. This recommendation was approved on April 7, 2015 by KLHK through Recommendation Letter No. B-3106/Dep.IV/LH?PDALs/04/2015.

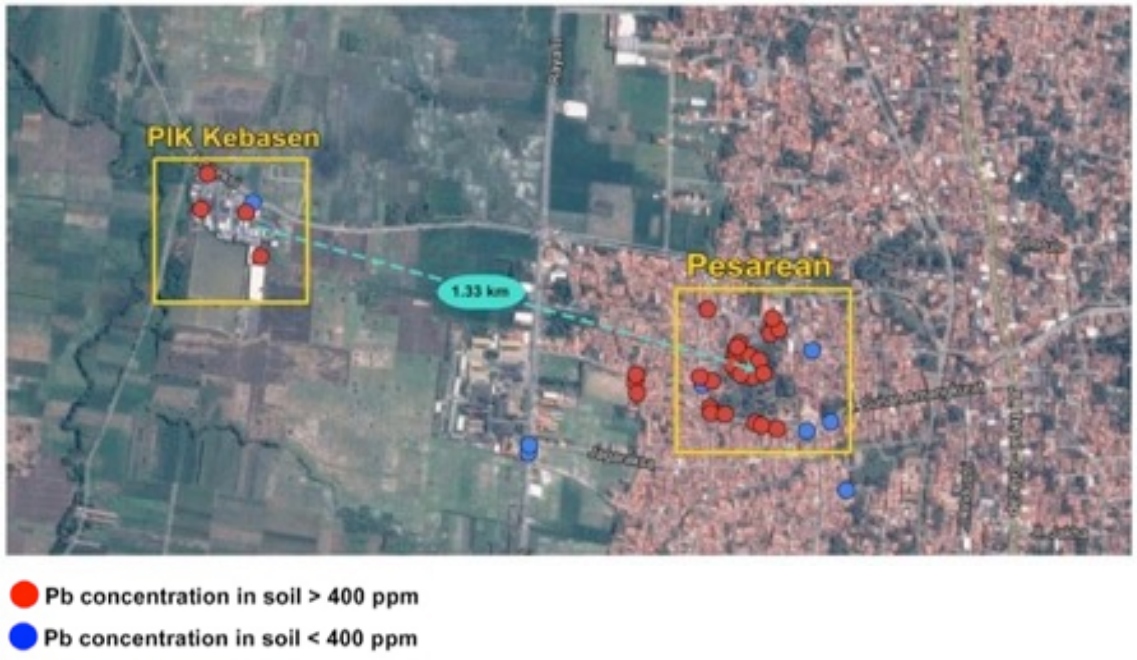
23. The project team selected a 1.3-hectare lead slag dumpsite in Pesarean village as the Indonesian pilot site. Pesarean is located in the Adiwerna subdistrict of Tegal Regency in Central Java. The village name comes from the Javanese word "sare," meaning sleep, and the word itself, "pesarean" is used to indicate a burial ground. This village is the final resting place of Sunan Amangkurat 1 and Raden Ajeng Kardinah, whose tombs in the center of the village have become tourist sites.

24. The total village population is about 12,675 people, according to the Kecamatan Adiwerna statistics from 2013. The village is comprised of a residential area surrounding the historic tomb site, an adjacent community cemetery, and a waste dumpsite with several active metal smelters. For more than half a century, villagers have worked with aluminum, copper, lead, mercury, tin, and iron, along with recycling scrap metal and used car batteries. An

estimated 40 metal shops are currently scattered throughout the residential area. Between 2010-2014, the local government relocated most smelters to an industrial area (The PIK, Kebasen) 1.3 kilometers west of the village. It is believed that all but one of the lead smelters have been closed or relocated.

Figure 7. Map of Pesarean

Figure 8. Map of Pesarean with Industrial Zone



25. There are approximately 673 housing units with several new residences currently under construction in the village. Small restaurants and shops line a main road, 2 schools serve about 585 students, and a government office sits just across from the main square. Many houses are located on former smelter sites, with about 5 located on the waste dumpsite itself. There are several houses in the area surrounding the known active lead smelter and additional houses surrounding shops that are utilizing lead slag, battery parts, or other lead contaminated waste from lead smelting. While this project is focused only on the waste dumpsite in terms of redevelopment planning, the remediation project should encompass contaminated yards, paths, schoolyards, and residences as well as the waste dumpsite. Figure 9 below shows the waste dumpsite that is recommended as the potential redevelopment site.

Figure 9. Waste dumpsite in the center of village

BASELINE STUDY

26. Previous studies collected extensive field data about contamination in the village and related health effects. The project team reviewed those studies and supplemented them with their own site visits, soil sampling, interviews, surveys, and focus group discussions. The team used that information to develop a baseline study, a conceptual site model, a remediation plan and a redevelopment plan for site.

Conceptual Site Model

27. The village and pilot site were evaluated using a Conceptual Site Model (CSM). The CSM outlines the physical characteristics of the site, the likely distribution and migration of contaminants, and the governmental, social, and environmental factors that must be considered in analyzing the site for both its remediation and redevelopment options. For Pesarean Village, developing the CSM involved four major reviews:

    - Contamination Source: metal smelting and waste disposed of improperly
    - Exposure Pathways: people exposed to lead dust, slag, or smelting residue
    - Risk Analysis and Remediation Prioritization: waste dump, residences, and schools
    - Remediation Options Analysis and Feasibility Recommendation

Contamination Source

28. Smelting activities create most of the waste and contamination of concern in the village. In the process of smelting, scrap metals are melted to separate and extract the more valuable materials. In Pesarean the smelting process is usually done over an open fire. Fluxes are added to control melting temperatures and to catalyze reactions. Reducing agents, usually charcoal or coke, are used to remove oxygen and other impurities from the metal. The result is elemental metal, which is poured off to form ingots. Contaminated materials generated in this process include fumes, ash and slag from smelting, as well as contaminated refractories from the oven or pit area. This contamination is spread through improper disposal, such as dumping slag and ash in the waste dump in the village center; fire smoke and fumes which then settle in the village; dust from metal smelting shops and nearby streets; contaminated clothing of workers; and spillage and dust from transport and handling.

29. Previous studies in Pesarean have reviewed soil and water contamination as well as high blood lead levels in the residents. In 2005, a study by Universitas Negeri Semarang looked at household water quality and recommended that people in Pesarean stop using well water for cooking and drinking. In 2011, the Ministry of Environment appointed a research

team from Padjadjaran University to conduct geology and hydrogeology studies in Pesarean Village. The Padjadjaran team reported metal pollution in groundwater, namely copper (Cu), zinc (Zn) and lead (Pb).

30. In Pure Earth's studies, villagers reported that they do not use the wells for drinking or cooking, as they have been warned about contamination. Most villagers purchase their drinking and cooking water or use the city water supply, which is sourced from clean springs by the local water authority (PDAM). While some local rivers are utilized for irrigation, there is little potential for significant lead ingestion given the use patterns of this water. The irrigation water is not used for drinking or washing. For these reasons, Pure Earth determined that private wells and groundwater are currently not a pathway of concern for heavy metal exposure for residents. There are, however, other water-related issues in the village. There are drainage problems throughout the village leading to muddy areas and flooding in heavy rain. Poor storm water drainage has the potential to spread waste or contaminated soil and sediment through the village and should be addressed by and future project.

31. ULAB recycling and further processing of byproducts (i.e. lead, slag, ash) has increased over the previous decade in Pesarean. The increased activity has heightened residents' exposure risk to toxic levels of lead. Lead is of major concern because it is a cumulative toxin that affects multiple body systems, including the neurological, hematological, gastrointestinal, cardiovascular and renal systems. Children are particularly vulnerable to the neurotoxic effects of lead, and even relatively low levels of exposure can cause serious, and in some cases irreversible, neurological damage. Lead accumulates in human teeth and bones over time and can again become mobilized in a woman's body when she is pregnant.

32. Lead and other metals do not degrade and thus continue to contaminate even if the exposure source (like a smelter) is removed. Lead accumulates at the soil surface where people are most likely to be exposed. Even if the active source of lead is removed, it can leave behind years of lead ash, dust, and other particles. Free particles may coat surfaces,

bind to soil and sediments, and become air-/waterborne when disturbed or uncovered because of flooding. Additionally, if waste products of smelting, such as slag, ash and used refractory are not properly disposed of, the waste itself becomes a source of exposure, often being dumped, transported, or subjected to hand-breaking and other forms of recovery or scavenging.

Exposure Pathways

33. Contamination from metal smelting and related activities spreads from the metal shops in a variety of ways. Pathways of contaminant exposure include airborne transmission, run-off, physical contact with lead particles, and subsequent deposition (followed by hand-to-mouth contact).

34. Airborne Transmission of contaminants from metal smelting occurs from smoke release during the burning, melting, and smelting processes. Smoke may emanate from indoor-operations that funnel emissions outdoors using chimneys, or from open outdoor pits made in yards. Wind can carry contaminants that are released from burning and breaking used car batteries and slag, especially in arid regions. Those directly breathing the fumes or smoke from burning are most at risk of inhalation exposure; the rest of the population are more likely exposed by ingestion of the particles through hand-to-mouth contact, especially children.

35. Run-off Transmission often occurs in rainy seasons as water may collect and redeposit contaminated dust or soil from roofs, ground surfaces, or sediments in flooding or water flows. Thus, run-off should be addressed in contamination assessments and engineering designs, including those for areas of temporary storage of waste during the remediation.

36. Direct Exposures to lead occur with workers in metal shops, children that play at the waste dump, people that walk through the waste dump in the village center, and vehicles that traverse the area. Workers come into contact with lead dust while breaking batteries and slag, transporting the materials, and digging in waste piles. Leaded dust may adhere to their exposed skin, hair, clothing, and shoes. Workers transport this lead back home, depositing it along paths. Additionally, the team observed children digging and playing in the dirt at the

waste dump, running barefoot, and playing on the mounds of lead dust. This behavior results in direct lead exposure that is easily transmitted from hands to mouths.

37. Other direct exposures are occurring because children, who frequently do not wear shoes in the village, are collecting lead dust on their feet and tracking it back into their homes. Adults typically wear shoes and remove them at the door of their homes, but their shoes also are collecting and depositing lead throughout yards and along paths.

38. Vehicles and handcarts collect and deposit lead dust throughout the village and along paths, as they transport both lead slag and ingots to and from the industrial site, metal shops, and storage rooms.

39. Further direct exposures are a result of the easy access to waste throughout the village. Residents have used the contaminated ash in home construction (in cement flooring for example), and as fill soil throughout the village. Additionally, battery casings were repurposed as building blocks for walls and sidewalks.

40. Exposures from the Dump Site are of particular concern because of the site's centrality. People come into contact with the contaminated soil by walking or biking on paths through the site, which are a frequent route of travel though the village. Children walk through the site to and from the nearby schools and play in the area with friends.

41. The dumpsite remains active. The project team observed people dragging ashes from nearby smelters and dumping them, resulting in a cloud of dust blowing around the site, into local houses and shops and coating local bicycles and anyone in the vicinity. The piles of ash are likely to be windblown because they have few plants or grasses covering them in the dry season, leaving ashes uncovered and exposed to any disturbance from wind, bicycles, motorbikes, or feet. Reducing exposures at the dumpsite will require preventing direct contact between people and the contaminated material and taking precautions to minimize dust during remediation.

42. In addition to the exposures from people walking through the dumpsite or living nearby, there are people exposed because they live or work there. There are several homes, businesses, and storage buildings at the waste dumpsite. Residents there have used ash from the site in construction of their homes, employees work in proximity to the dumped ash, and transporters come and go throughout the day, delivering slag, recyclables, and ingots, increasing the exposures of these populations.

43. Schools and the cemetery were investigated because of the potential exposure of children and the frequency of contact. Both areas had moderate to high levels of contamination due to deposited dust on unpaved pathways or yards. There are approximately 351 students at the high school near the dumpsite and 214 students at the two elementary schools in the project area who are all potentially exposed. Windblown dust from the schoolyard can be deposited and then carried on children's clothes and shoes, or they may get contaminated dust on their hands during play that can end up being ingested. Either paving the area or adding clean soil on open ground can help to reduce schoolyard exposures.

44. The cemetery is adjacent to the dumpsite and the path through the cemetary is a main thoroughfare in the village. People walking through the cemetery are exposed to dust along the path; visiting families are further exposed when they sweep the graves and burn trash or vegetation; and children play in the trees and throughout the site. The exposures can be greatly reduced by paving the frequently traveled walkway, repairing the drainage system to prevent flooding, and adding clean soil over the graves. Special precautions must be taken in remediating this religiously and culturally sensitive area.

45. Lead Dust Exposure at the PIK or other metal shops leads to potential exposure to contamination from direct contact with smoke, fumes, dust and heavy metal wastes. Those working in the smelters are breathing in lead directly from the smoke and dust from smelting. They are also collecting the dust on their skin and clothing. This may harm to them and also to their families, as the dust is brought back to the home and into contact with other family members including children. Those at risk include not only the workers at the industrial facility and the lead smelter still operating in the village, but also those collecting

battery parts for recycling; breaking apart batteries, slag, or refractory for further metal recovery; scavenging in waste piles; or transporting and/or storing waste from the smelting and processing activities. All of the people coming into direct contact with the hazardous materials and also their families are at risk from residual lead being ingested or inhaled.

46. Pure Earth provided recommendations for upgrading the PIK operations to meet environmental, health and safety guidelines. General guidelines include providing showers and work clothing for employees, locking the gates to prevent scavenging, and ensuring toxic waste is not transported back into residential areas. These recommendations are included in Appendix H.

47. The very high lead contamination in the village is apparent in the blood lead levels of residents. A Mer-C study in 2011 reported that 88% of 400 tested adults had levels of lead in blood above 10 micrograms per deciliter (µg/dL) and 16% had blood lead levels equal to or above 45 µg/dL. A 2013 study of women of childbearing ages in Pesarean found average blood lead levels of 28.3 ug/dl with the maximum found to be 45.8 ug/dl. As a reference, the United States Government Centers for Disease Control and Prevention (CDC) uses 5 µg/dL as an indicator of exposure to lead at a level of concern and recommends treatment at a hospital, for anyone with a blood lead level 45 µg/dL or higher.

48. The TA team conducted community health assessments in Pesarean. Assessments included a survey of health problems reported to the Community Health Center (Puskesmas) and District Health Office; focus group discussions with lead smelter owner/workers and their partners; and blood sampling (using a Leadcare Analyzer II on site) in residents who work or live near smelters. The blood lead levels shown in Figure 10 indicate that 41 percent of the 46 people tested had blood lead levels equal to or greater than 45 micrograms per deciliter. Through the focus group discussions and surveys, the team learned that many children in the area were having difficulty achieving high grades at school and showed signs of problems with physical development. There also were several reported incidences of mental challenges and physical deformities among children and in some adults who worked closely with lead.

49. Based on the blood lead levels of villagers tested, it is clear that there is a need for clean-up in the central dumpsite and at homes and yards throughout the village. It is also critically important to educate the community about cleaning homes, improving worker protection and changing hygiene practices to prevent further lead exposures.

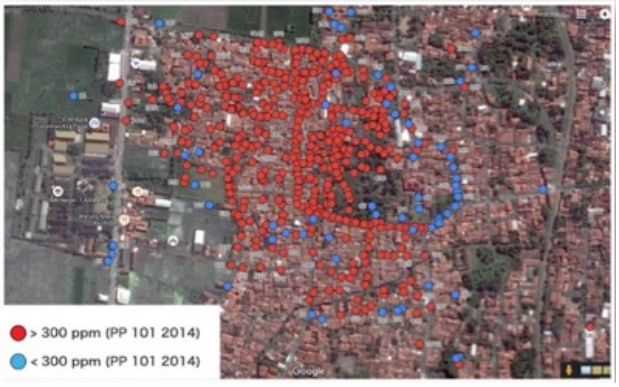
Figure 10. BLL test results comparison 2011 - 2015

Blood Lead Level (micrograms per deciliter)	2011 Mer-C Assessment (in % of 395 results)	2015 Pure Earth Assessment (in % of 46 results)
<15	20.5	2.2
15-24	18.2	23.9
25-34	36.4	19.6
35-44	9.1	13.0
45-54 (hospitalization recommended)	13.6	19.6
>55 (hospitalization recommended)	2.3	21.7

Remediation Requirements

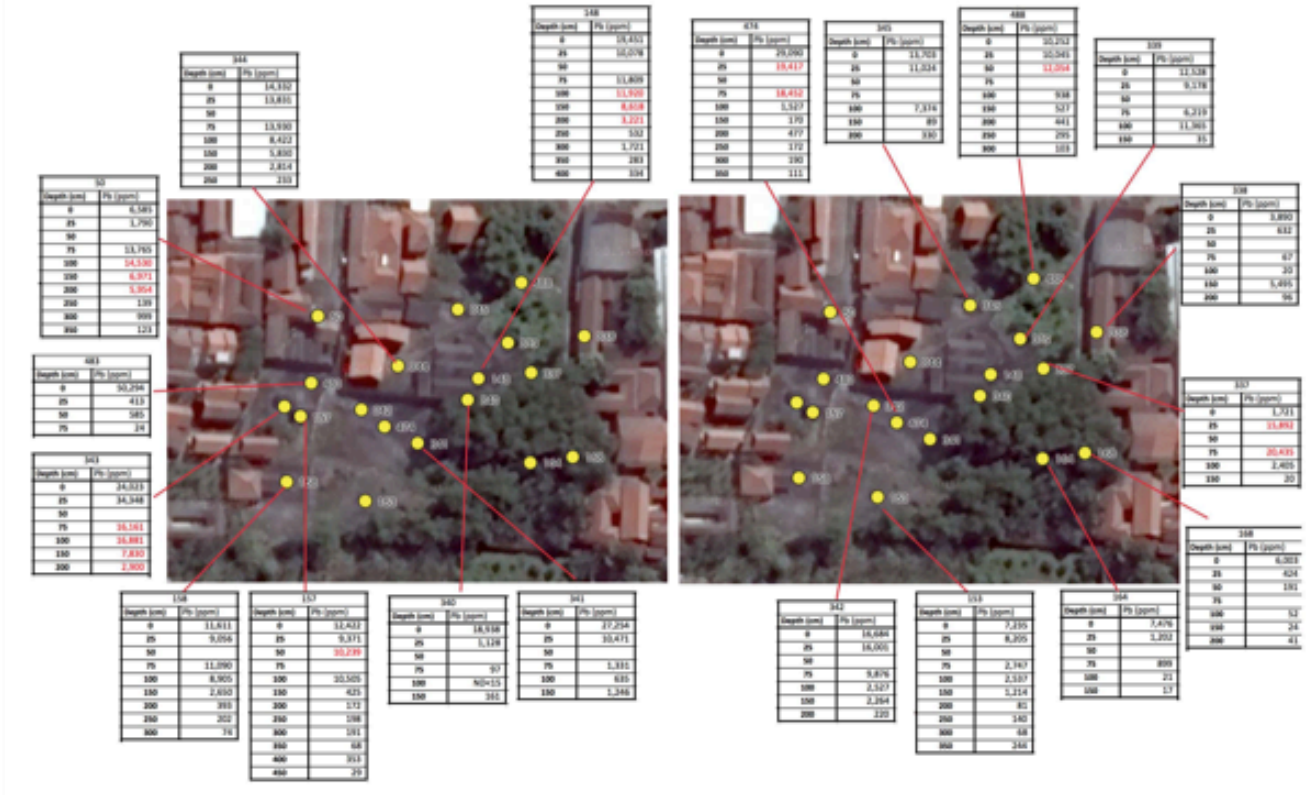
50. Pure Earth sampled the soil at 552 points in the village using a Portable X-Ray Fluorescence (XRF) Analyzer. The XRF meter was calibrated at the start of every day of sampling to assure quality and both electronic and handwritten records were kept containing sample coordinates and results. The results are summarized on a map in Figure 11. Soil contamination was found in both the dumpsite and the residential areas with the highest sample showing 54,902 parts per million (ppm) lead. As a reference, The Indonesian government considers soil above 300 ppm lead hazardous and the US EPA considers soil above 400 ppm lead hazardous for residential exposures.

Figure 11. Map of sampling results coded by parts per million (ppm) lead



51. In order to estimate the volume of metal waste and contaminated soil in the waste dump area, Pure Earth collected depth soil samples at 18 points throughout the site. The samples were collected using metal rods to advance boreholes by hand and an XRF to measure contamination at various depths. The samples showed high concentrations of lead up to 4 meters deep in several areas, although in general, the depth of contamination over 300 milligrams/kilogram (mg/kg) lead) was 2 meters or less. The results of this sampling are shown in Figure 13. Based on the depth sampling studies, the Pure Earth team estimated that there are approximately 17,900 cubic meters of metal ash, slag waste, and contaminated soil that exceed the 300 mg/kg lead standard at the central dumpsite. This site covers roughly 13,000 square meters.

Figure 12. Map of Depth Sampling Results



52. In addition, depth samples were taken at the football field and high school yard. Contamination above 300 milligrams per kilogram (mg/kg) was found only at shallow levels, less than 0.25 meters. This finding is consistent with Pure Earth's experience in other projects: lead and other insoluble metals tend to stay on or close to the surface when deposition is a result of dust or incidental spills (as opposed to waste dumping.)

53. The TA team also surveyed unpaved open space, yards, alleys and roadsides in the project area to estimate the amount of contaminated soil in these areas. The survey found 48 open spaces or yards, 23 unpaved alleys, and 7 roads with significant unpaved areas along the sides. The area of the high school yard and the public cemetery were also measured. The results of this analysis are shown in Figure 14 below. Based on an average depth of contamination of 15 centimeters, the team estimated that there are 20,016 cubic meters of contaminated soil in the village. A 15 centimeters average depth of excavation is based on what Pure Earth has found in similar projects around the world and is consistent with depth sampling at the football field and high school. Finally, the estimated volume of the roughly 20 slag and ash piles scattered through the project area in open spaces is estimated to be about 120 cubic meters, based on a conservative average size of 2 x 3 meters width and 0.75 meters height.

54. Based on these measurements, Pure Earth confirmed that the soil in the village is highly contaminated, both in the dumpsite and in the surrounding mixed-use residential-industrial-public areas. The total volume of metal slag and ash waste plus contaminated soil with more than 300 mg/kg lead is estimated to be approximately 20,000 cubic meters, excluding the public cemetery.

Figure 13. Contaminated Soil Volume Estimates

LOCATION	AREA (m2)	VOLUME of contaminated material (m3)	COMMENT
Dumpsite	13,000	18,000.00	as per depth sampling
Yards & Open Space	11,427	1,714.12	if excavated to 15 cm
Unpaved Paths	1,352	202.80	if excavated to 15 cm
High School Yard	660	99.00	if excavated to 15 cm
Public Cemetery	12,000		not included
Totals	13,439	20,015.92	yards, alleys, high school

Risk Analysis and Prioritization

55. After reviewing the contamination levels, sources, and pathways to exposure, the team developed a matrix to rank the public health risk of each contaminated area and identify priority areas for clean-up. The results show that the lowest risk to health is the contamination in the cemetery. While this area should be addressed in the project, exposures there are mainly from people traversing the site to go between the waste dump site and the main road. The highest risk areas and thus the recommended priority areas for the clean-up are:

    - the yards with waste piles;
    - the dump site;
    - home interiors;
    - unpaved pathways

56. Because the waste dumpsite is the redevelopment area, the development plans focus on that area specifically but the remediation plans take into account all of the high priority remediation areas in the village. Also, the remediation plans for the village already have a potential funding source, making it possible to create remediation plans that focus on more than just the development site.

Remediation Methods

57. The remediation alternatives for Pesarean were included in an in-depth study funded by DANIDA. The results of the study and subsequent decision by the local, regency, and

national stakeholders was that the costs of sending the waste to the hazardous waste landfill were too high and that in-situ encapsulation was not possible due to a lack of suitable locations and unwillingness on the part of the local government to take responsibility for ongoing maintenance and oversight. Therefore, the chosen option was to remove the hazardous material, transport it to a facility where it can be solidified into paving bricks.

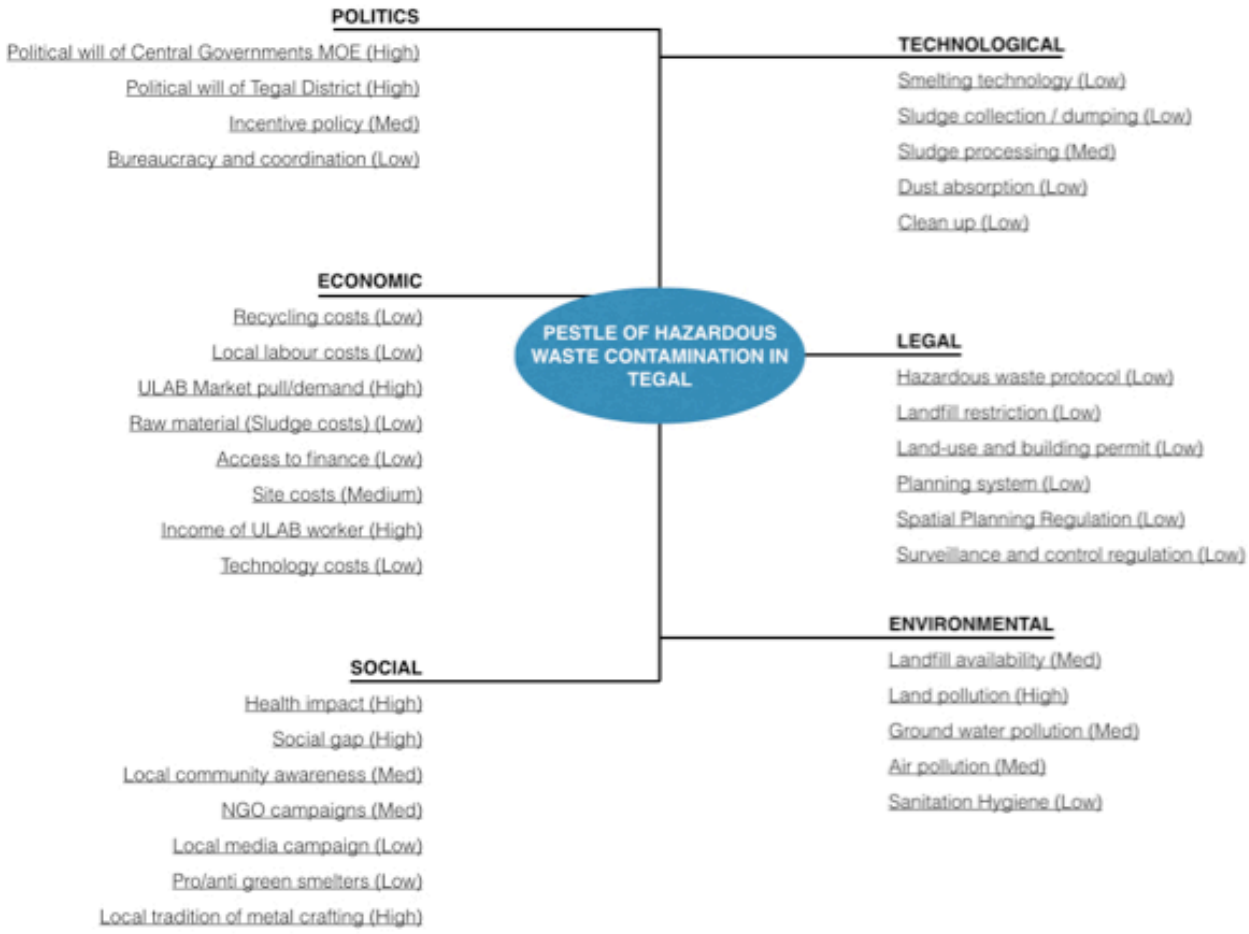
Remediation Costs

58. Given the remediation method preferred by the local and national government — removal of hazardous waste and solidification into pavers — the estimated costs are approximately 25 billion IDR. DANIDA and the Indonesian government are expected to provide support and funds to enable remediation.

REDEVELOPMENT PLANS

59. When the waste dump is remediated, there will be an opportunity to redevelop and revitalize the site. As part of this TA, the project team worked with local and international experts in redevelopment at contaminated sites. The team reviewed local strengths and potential, current population trends, housing and retail in the village, and especially important in Pesarean, the tourism potential because of the historic tombs in the village. The team researched the technological, environmental, legal, leadership, economic and social aspects of the village, its contamination, the required remediation and the potential for redevelopment. The key results of that work are highlighted in Figure 15 below.

Figure 14. PESTLE Analysis, Pesarean Village



60. After compiling data, interviewing local stakeholders, and working closely with the community throughout the remediation investigations and related community meetings, the team collaborated on a redevelopment vision for the village. The Strategic Urban Redevelopment Plan is included in this report in Appendix H. Key details are described in the following section.

61. The redevelopment vision outlined the key strengths and needs of the village:

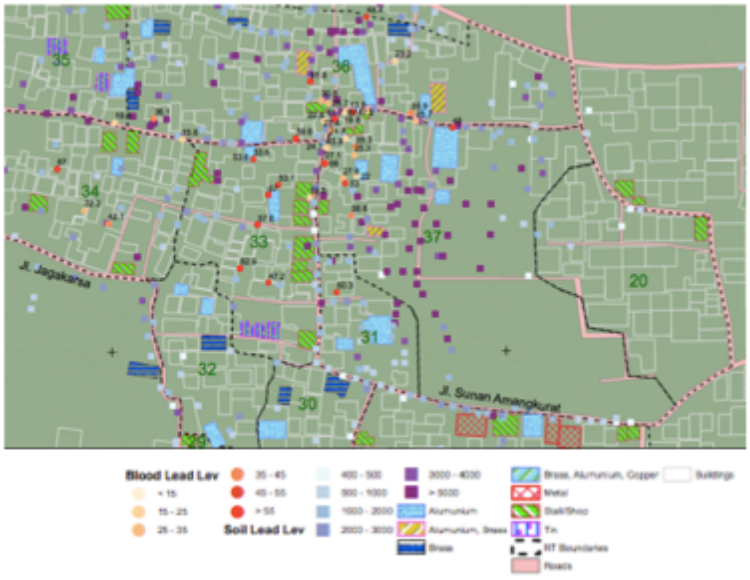
- it is in an easily accessible area with other tourism draws;
- there are historical and cultural assets that bring in regular tourism;
- there is a cemetery that can be revitalized;

- there is an involved stakeholder group including a very supportive and active local;
- government and an interested funding partner for remediation activities (DANIDA);
- zoning should be strengthened and enforced;
- there should be a remediation to make the village safe again;
- there is a need for alternative livelihoods training and funding as well as for changes in smelter operations and locations;
- there is a need for a public water tank and communal sanitation program;
- there is a need for low-cost housing;
- there is a need for improved drainage;

Alternative Livelihoods

62. A key part of the Redevelopment plan is to address the need for alternative livelihoods, training, access to capital, relocation options for smelters, and marketplaces for crafts or food sales. Metal crafting has been a key occupation in the village of Pesarean historically. More recently, used lead acid battery recycling and other metal smelting activities has increased. The map in Figure 16 below shows the locations of smelters in the village.

Figure 15. Smelter Locations, Pesarean Village



63. Currently metal crafts in the village are still concentrated in the automotive market to meet local and national demand, but there is potential for metal crafts to be produced in the village to be sold at a marketplace as part of the new development. The project team proposes developing training centers specializing in craft work and metal recycling, craft education, vocational curriculum, and creative industry.

64. The people interviewed as part of the focus group discussions recognize the smelting as dangerous for their health and their families. They are earning money to support their families but would be willing to do other work if it earned the same income.

65. The team does not recommend a drastic change in the livelihoods in the village. Pesarean is closely tied to metal working. Therefore, it is recommended that livelihood programs focus on making sure workers are protected, using best practices in metal smelting, that all smelting activities are moved away from industrial areas, and that capacity building training be provided for those looking to gain new skills.

66. The redevelopment plans include a center for skills-based training. The TA recommends that a partnership be developed with a local trade school to help those who currently scavenge in the metal smelting ash or whose livelihoods would be disrupted by the relocation of smelters to an industrial zone outside of the residential areas. The local government and community were supportive of this concept in the initial community meetings.

67. Education and business planning services are needed in Pesarean for residents who may be interested in changing their livelihoods. For example, during the community meetings, several women who make snacks and foods in the village expressed interest in trainings to help them build or develop businesses. Additionally, when the waste dump is cleaned and the industrial zone no longer allows the public to access the waste piles there, people who currently dig in the waste piles to retrieve left over metals will no longer have that opportunity. Any new educational opportunities or livelihoods trainings in the village should involve that population whenever possible.

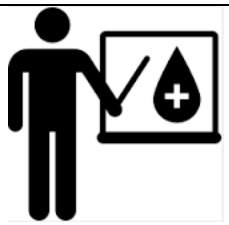
68. The team held a series of community workshops to review the current challenges, the potential for redevelopment, the associated costs, and to gather feedback and ideas from the stakeholders. What resulted was the framework for what should be included in the redevelopment plan. Figure 17 shows the development framework for Pesarean Village.

Figure 16. Development Opportunities, Pesarean Village

	Physical Improvement
	Low-cost housing design and development
	Drainage design and construction
	Communal sanitation program
	Development of public cemetery
	Installation of public water tank

	Economic Development
	Metal Assembly Workshop
	Special small-holders assembling site
	Revitalization of Amangkurat Cemetery
	Micro-credit support for livelihoods
	Culinary and crafts business development

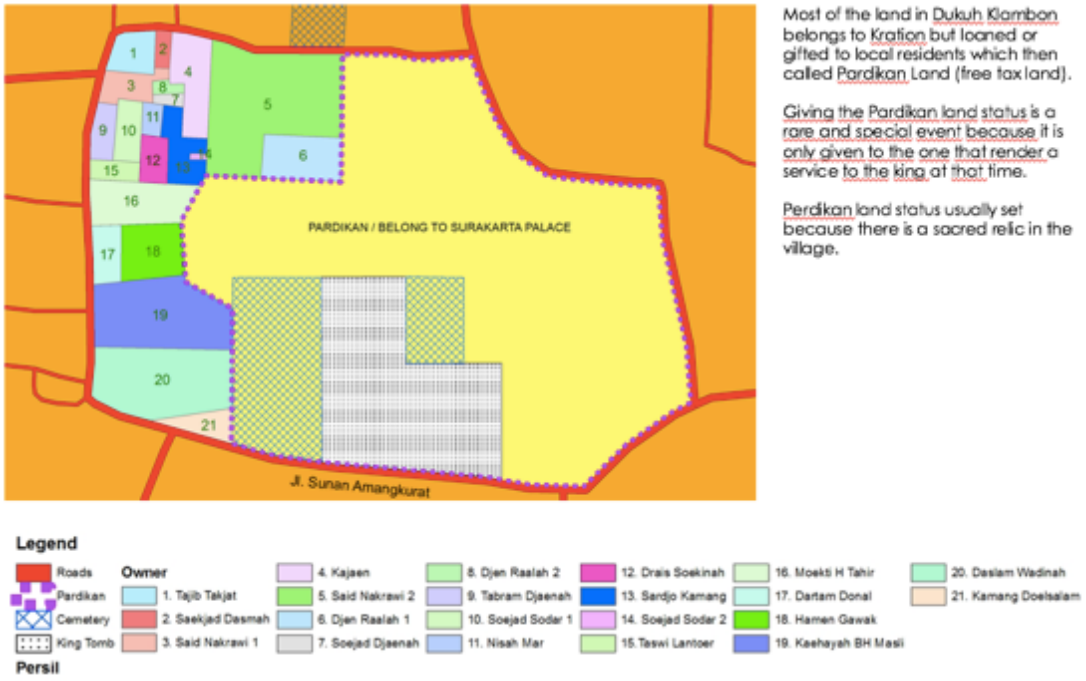
	Health & Environmental Recovery
	Remediation of contaminated sites
	Green space development
	Improved land use and zoning
	Contamination awareness and recovery program

	Training and Education
	Metal Crafting training center
	Health and Sanitation training
	Environmental Regulations compliance training

	Community Empowerment
	Local enforcement mechanisms education and empowerment
	Strengthening youth, women, and religious organizations
	Support healthy living and home renovations

69. A challenge to be addressed in this project is that there are currently several residences and businesses at the waste dump with multiple owners. Also, the tomb site is owned by Surakarta Palace. In order to enact the development plan, the local government (and perhaps the national government) must partner with these owners. This may require relocation and compensation for landowners. The land ownership at the site is detailed in Figure 18 below.

Figure 17. Land Ownership, Waste Dumpsite

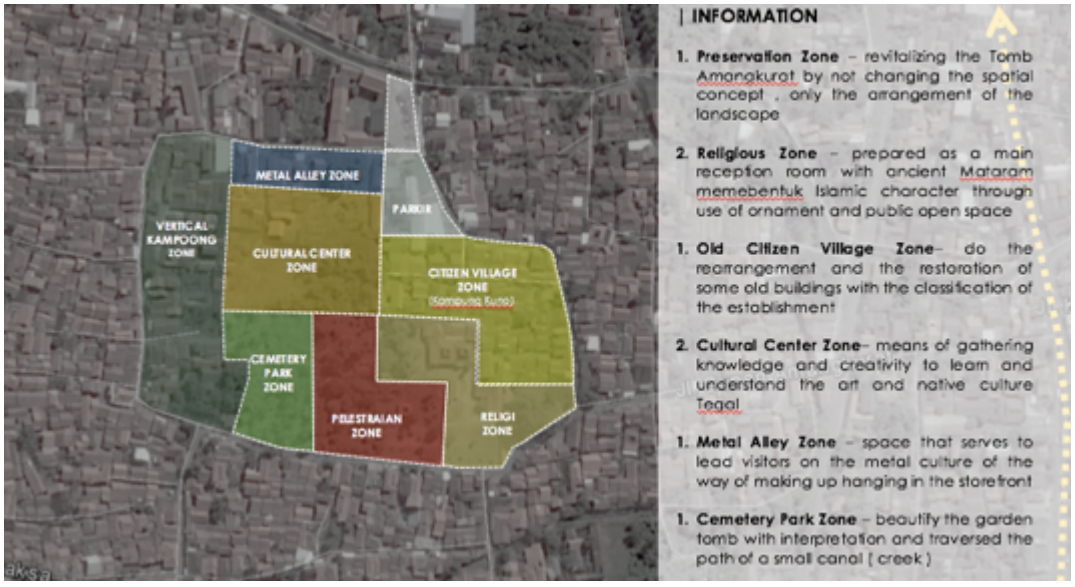


70. Using this framework as a guide, the TA team then created the Strategic Urban Redevelopment Plan. The plan is included as Appendix H and key details are presented below. The redevelopment site is the waste dumpsite, the cemetery, the village square, the old village residences bordering the tomb and mosque. The area of the village focused on for redevelopment is shown in Figure 19 below.

Figure 18. Redevelopment Area, Pesarean Village

71. In order to highlight the historical significance of the village and its tourism potential, the TA team recommended that the redevelopment adhere to the Old Mataram-style architecture of Central Java. Additional aspects of the development include: revitalizing the tomb sites, old village and older homes; designating a religious zone for the mosque; establishing a public green space and cultural center; designating space for a "metal alley" for stalls to sell crafts and food; and beautifying the cemetery area with the construction of a garden and park. The various areas of development are indicated on Figure 20 below.

Figure 19. Development zones, Pesarean site



72. The team then shared architectural drawings at community and stakeholder meetings to illustrate the proposed development scheme. Figures 21 and 22 are two of the architectural renderings presented at previous meetings.

Figure 20. Rendering, Pesarean Development Plan

Figure 21. Birds Eye View, Pesarean Development Plan

ESTIMATED COSTS OF DEVELOPMENT

73. The team valuated the proposed development scheme at approximately 80,186,000,000 IDR (roughly $US 6M). The valuation considers mainly the cost of construction, which includes: the parking area, the ticket area, the Mataram Square, cultural center and amphitheater, refurbishing the old-style residential area, creating “metal alley” for craftsmen, the food court for local vendors, the vertical kampong housing development, the redesigned cemetery park, transportation improvements, and other revitalization costs.

Figure 22. Investment Components

74.

Investment Components (IDR millions)

Investment Components	Amount
Drop off plaza and parking area	1,989
Ticket area	709
Mataram square	990
Cultural center	9,099
Amphitheater	12,000
Old residential area	100
Metal alley	1,932
Food court	2,139
Vertical kampong	44,035
Cemetery park	2,940
Road widening	310
Improvement of remaining area	3,943
TOTAL	**80,186**

75. The annual operating costs for the redeveloped area are estimated at 474,000,000 IDR (approximately US$ 36,000). This includes labor costs, electric expenses, and water supply. Details are listed in Figure 24 below.

Figure 23. Annual Operating Costs

76.

Annual Operational Cost Components (IDR Millions)

Cost Component	Amount
Manpower	462
Electricity Supply	6
Water Suplly	6
TOTAL	**474**

77. The expected revenue from the project is shown below. The revenue will come from tourism, local rents, and sale of housing. The largest revenue source is expected to be admission to the tomb (ticket price ~20,000 IDR). Another important source of income is ticket sales to the Metal Museum (suggested ticket price ~10,000 IDR). Parking charges are

expected to generate revenue as well. The planned parking capacity could accommodate 10 tour buses, 30 cars, and 300 motorcycles (suggested parking costs ~20,000; 5,000; and 2,000 IDR respectively). There are also revenue components that are not associated with the number of visitors. For example, rental of the auditorium and amphitheater for private events (suggested rental prices ~4 million IDR and 2 million IDR respectively) will incur regular costs. Finally, there are the housing unit sales to consider. There would be sales of the residential units in the Kampoong area. Half of the 120 units are to be allocated for villagers whose homes would be removed for the redevelopment. The other 60 would be sold for a suggested 403.65 million IDR each.

Figure 24. Estimated Annual Revenues

Annual Revenue (IDR Millions)

Revenue Component	Amount
Parking Area	1,071
Ticket Sale of Amangkurat Tomb	18,000
Pendopo Rent	36
Auditorium Rent	24
Ticket Sale of Metal Museum	4,500
Food Court Rent	360
Amphitheater	90
TOTAL	**24,081**

78. It is expected that because of the revolving revenues, the project will begin to generate revenues quite quickly. The estimated cash flow is shown below in Figure 26.

Figure 25. Anticipated Revenues

Year	Cost			Revenue	Cash Flow
	Initial Investment	Operational	Total		
1	80,186	474	80,660	50,722	-29,938
2		474	474	24,081	23,607
3		474	474	24,081	23,607
4		474	474	24,081	23,607
5		474	474	24,081	23,607
6		474	474	24,081	23,607
7		474	474	24,081	23,607
8		474	474	24,081	23,607
9		474	474	24,081	23,607
10		474	474	24,081	23,607
..	..	..	..	..	..

79. To assess the feasibility of the project, the team used the Net Present Value and Internal Rate of Return. Using the Central Bank of Indonesia savings rate, 7.5%, the results are shown in Figure 27 below.

Figure 26. Internal Rate of Return

Time periode	5 years
Discount rate	7.50%
NPV	45,702
IRR	37%

80. There are also promising potential investors or funders in the remediation and redevelopment. The local planning agency has a budget of up to 175 million IDR for the industrial technology capacity building, the tourism and cultural agency has a budget of up to 25 million IDR for cultural values promotion, and the enterprise development agency has a budget of up to 250 million for market infrastructure development. The Danish

Development Agency (DANIDA) is likely to fund the remediation component of the project and potentially some of the upgrades to the PIK, Kebasen industrial facility.

ACTION PLAN FOR IMPLEMENTATION

81. The local and national government will lead the stakeholder group that will be taking charge of the remediation and redevelopment of Pesarean village. Local and national governments in each TA country have been closely involved in all of the work under this TA, as well as leading their own investigations into the contamination in the village and working to relocate the smelters away from residential areas. They will be closely involved in the planning for the remediation, the rezoning efforts, the relocation of residents from the dumpsite, and the relocation of remaining smelters to an industrial area. The key next steps as recommended by the team are:

    - Spatial planning and zoning to separate smelting from residential areas
    - Removal of residents and smelters from the waste dump which will require local government support
    - An eco-recycling industrial corridor established to relocate the remaining smelters per DANIDA's requirements before funds are approved for remediation
    - Support for the implementation of suggested best practices at the PIK, Kebasen which may require government subsidy
    - Community education and cleanup as part of the remediation process and to protect residents from further exposures
    - Holding a meeting with potential developers to show them the possibilities of the development and find out if there are any investors interested. This may require government incentives to complete a contract.

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Guidebook on Pollution Control and Remediation for SME's

Chapter 5

Chapter 5

Guidebook on Pollution Control and Remediation for SME's

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CHAPTER SUMMARY

1. The purpose of this TA is to address the sources of hazardous waste contamination from small and medium industries in Indonesia and the Philippines. The TA fulfills this objective through technical and administrative capacity building with governments in each country. A significant component to the capacity building strategy includes advising governments on their potential to mitigate risks to human health while planning for inclusive urban growth. This is the second chapter of five that comprise the final report for the TA. The preceding chapter of this report outlined the regulatory environment, the economic and livelihood limitations and aspirations of small-scale owners and workers, the related informal economies around waste management (i.e. waste picking, scavenging), and the required capacity building among national and local governments and the public to prevent human exposure to hazardous waste. A key factor in establishing effective risk mitigation programs is to institute pollution controls that prevent or severely limit toxic releases into the environment. Moreover, legacy

pollution sites — which are remnants from past activities for which a responsible party may not be identifiable and thus not held liable — should be identified and assessed, with public access to the area being limited to the extent possible until remediation is feasible. This chapter outlines commonly adopted best practices for pollution control and describes in detail the process for undertaking a remediation project.

BEST PRACTICES IN POLLUTION CONTROL – INDUSTRY SPECIFIC RECOMMENDATIONS

2. The best practices for industry in pollution control efforts have been well documented. The project team introduced stakeholders to commonly adopted pollution controls and invited resource speakers to discuss industry specific best practices throughout a series of workshops. The list below outlines generally preferred pollution prevention methods and best practices as outlined by the International Labour Organization of the United Nations and is referenced in the project materials.

Pollution Prevention - Air

- Common air cleaning devices include:
  - ✓ Inertial separators, filters, meshes, permeable barriers, or baghouses, enclosed systems, precipitators, scrubbers, adsorption beds, afterburners, combustion devices, covering or spraying loose piles of contaminants that could become windblown, and/or applying surface coatings

Pollution Prevention - Water

- Typical wastewater treatment methods
  - ✓ Remove suspended solids, sedimentation and sludging, filtration and disinfection (varying intensity depending on end use)
- Thermal water pollution control

- ✓ Cooling towers or ponds, re-use rather than discharge

- Groundwater protection
  - ✓ Enacting zoning and land use restrictions, aquifer, river basin and water supply mapping and risk management
- For all pollution control methods, proper operation and maintenance for highest efficiency are of key importance, energy requirements and costs of operation and maintenance must be considered and adequately planned for, and regular, detailed inspections are required by the operator and by the enforcement agency

Pollution Prevention - Soil

- Typical techniques include
  - ✓ Destruction, encapsulation, bio-remediation, solidification, soil washing, thermal desorption, and/or disposal at a permitted landfill

Waste Management Strategies

- ✓ Separation at source, collection and transport without release along path, temporary storage at appropriately managed facilities, recycling and processing, incineration, anaerobic digestion or composting for fertilizer or energy production, detoxification

Landfill/Covering best practices

- ✓ Multilayer isolation (clay, geotextiles, plastic, etc.); water diversion and leachate drainage, gas release mechanisms, waterproof cover, institutional controls to prevent improper future land use

Cleaner Technologies and Best Practices

- ✓ Substitution of less toxic materials in place of highly toxic materials, phase out or use restrictions of toxins
- ✓ Change in form of inputs used, change in processing methods, or product reformulation in order to reduce or eliminate dust, emissions, or waste

- ✓ Change in plant layout to prevent dispersion of pollutants or allow clustering of cleaning systems, modernization or modifications to reduce amounts of toxins used or generated
- ✓ Strict sanitation and worker protection and environmental awareness (preventing dumping, reporting spills or risks of exposure, taking rain, wind, and flooding into account before spraying, piling, transporting, etc.)
- ✓ Spraying or covering loose materials to prevent dispersion, applying surface coatings to prevent release of pollutants, or encapsulating materials
- ✓ Land use planning and zoning to prevent residential exposures to toxins, permitting and registration requirements, emissions testing and ongoing monitoring, isolation of industry

3. In addition to the general pollution control best practices, the project team documented the recommended pollution control measures specifically for lead smelters, gold smelters, and tanneries. These recommendations are outlined below.

Lead Smelters

4. For lead smelters, the recommended best practices are:
   - to discourage hand-breaking of batteries and to use a battery saw or machine breaker,
   - to use ventilation hoods and a baghouse to filter dust and particulates,
   - to contain and evaporate electrolytes or refurbish them for reuse,
   - to de-sulfurize the paste to separate organic and nonorganic wastes,
   - to use an enclosed furnace,
   - to reuse slag in paving stones or other cement-based products, and
   - to keep clean, organized plants (institutional controls) with worker protections utilized (i.e., proper use of personal protection equipment, showers/changing rooms, separate ventilated eating areas, and fire/burn/spill safety equipment.

Gold Smelters

5. For gold smelters, the recommended best practice is to use electrolytic recovery of silver from the waste water. This process removes silver ions from the solution without the use of the copper displacement method. This process eliminates the use of copper and therefore the discharge of copper-nitrate rich effluent into the river. For best practices in air emissions control for gold smelters: a wet and dry scrubber system is recommended to filter particulate matter.

Tanneries

For tanneries, the recommended best practices in pollution control are:

- clear separation and good ventilation of areas for preparing chemicals, along with spill prevention and worker protections,
- separating tanning yard chromium laced effluents from beam house effluents to reduce the volume of hazardous waste water to be treated;
- treating beamhouse effluents with conventional biological methods through settlement tanks and sludging;
- treating chromium effluents to reduce hexavalent chromium to trivalent chromium, then use alkali precipitation and solidification and stabilization of chromium hydroxide sludge;
- standardizing the amounts of chromium used to prevent overuse;
- use of higher efficiency metal gear tannery drums to reduce the amount of chromium needed;
- environmentally sound management of all waste products to prevent accidental disposal of toxic materials into environment or municipal landfills; and
- consideration of chromium-free methods.

THE PROCESS OF REMEDIATION

6. In stakeholder workshops completed as part of the TA, the project team assembled resource speakers to support the capacity building activities. Resource speakers proposed remediation techniques and examples of successful remediation projects from

around the world, trained regulators in the particulars of environmentally sound management of lead smelting, and built stakeholder capacity in the process of identifying, assessing, and remediating contaminated sites. The TA compiled resources for governments or developers to use in identifying, assessing, scoping, and estimating budgets for the remediation of contaminated sites. Local and national governments can follow the tools developed as part of the TA to undertake remediation planning when addressing hazardous waste.

7. The proposed stages in remediation planning are:
    - Site assessment and prioritization - identifying and rapidly assessing a site, then developing the conceptual site model to clarify key toxins, paths of exposure and populations at risk;
    - assessing the site in detail to estimate volume, types of toxins to be addressed, and priority areas to address;
    - developing a matrix of remediation options and determining the most feasible options;
    - creating a detailed workplan and budget estimate.

Each of these steps is outlined below.

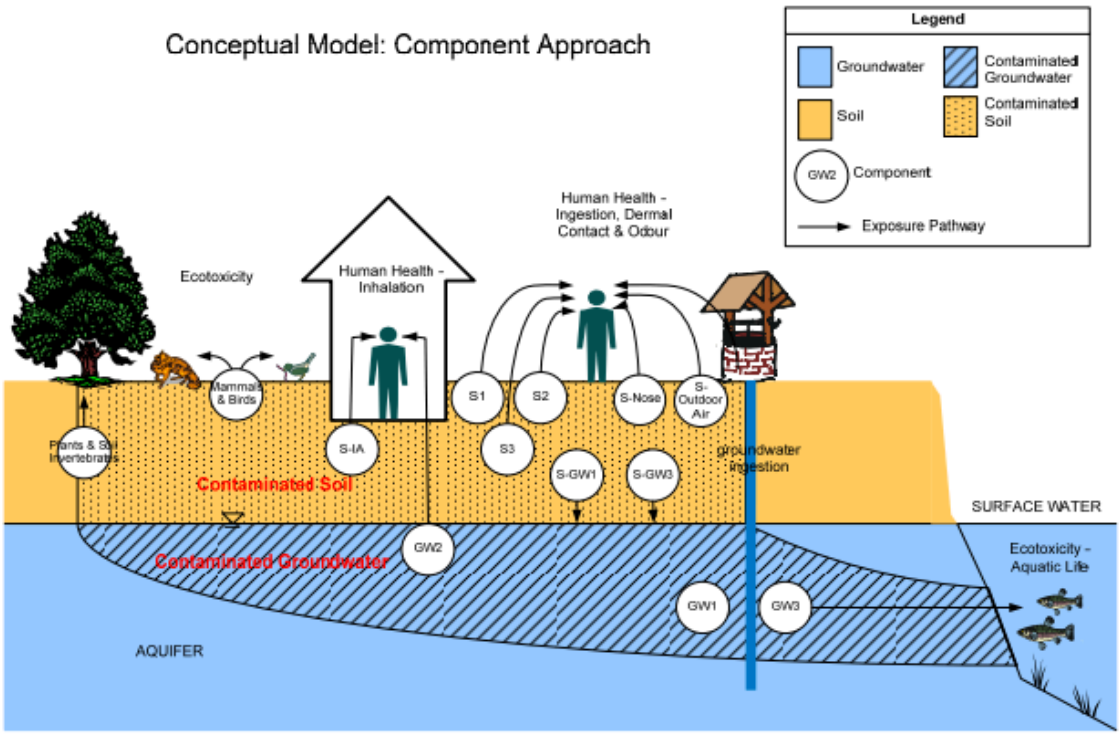
Site Assessment and Prioritization

8. Addressing contaminated sites in low- and middle-income countries first requires building an understanding of the major contaminants and their sources, where they are found, and how they could be harming human or environmental health. Pure Earth engages a Rapid Site Assessment model to identity and to collect data that helps to characterize hazardous waste at contaminated sites. The Rapid Site Assessment, which Pure Earth calls an Initial Site Screening, evaluates likely public health risks at a site based on three factors: 1) identification of a distinct pollution source; 2) a migration route through which the pollution reaches an area that people use or occupy; and 3) a

pathway into the body. It is important to note that interventions to prevent human health impacts from hazardous waste can address any or all of the three components. Effective risk mitigation can occur by: elimination of the source (i.e. waste removal or elimination of use of a toxin); control of migration routes (e.g. installation of pollution control equipment or covering a waste pile); elimination of pathways (e.g. paving over or encapsulating contaminated soil); or reducing people's access to an area (e.g. fencing off a dumpsite). Pure Earth has provided training in Initial Site Screening to the governments of Indonesia and The Philippines as well as local investigators in both countries through its Toxic Sites Identification Program and plans to continue these trainings throughout 2016-2018. The protocols for site screening are also available to the public on the Pure Earth website at http://www.pureearth.org/blacksmith-institute/coordinator-resources/.

9. When an identified site poses a determinable significant risk to public health — as determined by the scale and concentration of hazardous waste present, and the public's frequency of exposure — more data is collected in order to establish a Conceptual Site Model (CSM). The CSM integrates all of the information gained from the site assessment to characterize a site, the key pollutants to be addressed and their potential effects, the migration routes that must be considered, the pathways into the population that must be prevented, and highlights the unknown data or risk factors. The CSM then becomes the basis for future data gathering, remediation planning, and budgeting. A simplified CSM illustration is shown in Figure 1.

Figure 1. Example Conceptual Site Model



10. A key requirement for site assessment is access to a contaminant identification device either through a laboratory in country or through use of a pollutant concentration analyzer. These machines, while expensive, are essential components of a monitoring and management program at the local and national government level. Typical costs of monitoring equipment are indicated in Figure 2. Pure Earth prefers field-based equipment, which allows for rapid screening and adjustment of the conceptual site model in real time during an assessment as needed. However, for more precise analysis, Pure Earth recommends sending at least 10% of samples to a laboratory to confirm the validity of field-sampled data. For regulatory purposes, governments may require a similar protocol of sending a percentage of samples to a laboratory to confirm site assessment data.

Figure 2. Monitoring Equipment and Costs

field equipment	monitors	minimum cost (US)
X-Ray Fluorescence Analyzer	Soil Contamination	$30,000
Jerome Mercury Vapor Analyzer	Mercury in Air (headspace can be monitored for soil or water samples)	$9,000
Lumex Mercury Analyzer	Mercury in Air (attachments allow water, soil, solids testing)	$25,000
Particulate Matter (2.5) Monitor	Fine Particulate Matter in Air	Outdoor $8,000 Indoor $3,000
Draeger Pump and Tubes	Gases in Air	Pump $1,700 Tubes (1 time use, chemical specific 5-10 for $100
Hach Portable Chemical Test Kits	Multiple parameters in water or waste water (color dissolved solids, pH, phosphates, nitrates, arsenic, chlorine, petrochemicals)	One comprehensive test kit is $2,000
PhotoIonization Detector (Minirae 3000 or GX6000)	Gases in air and soil, VOCs	$2600
Colorimetric PCB test kits Dexsil CLO50SG-10 Clor-N-Oil PCB Screening Field Test Kit	PCBs in soil, sand, sediment, and clay	Pack of 10 for $200
Radiation dosimeter, Geiger counter	Ionizing radiation	$500

Global Positioning System (GPS) Device	Geolocation, allows for pinpointing where samples are taken and mapping	$100

Detailed Contamination Measurements

11. If hazardous waste contamination above recommended maximum exposure levels is detected, and there is local or government interest in remediation, a further detailed site characterization will be completed. A detailed site characterization, as opposed to the Rapid Site Assessment addressed above, should include:
    - a systemized sampling approach to allow for a greater number of data points. Investigators conducting a detailed site characterization may divide an area into a grid and collect evenly spaced samples (e.g. soil readings with an XRF every 10 meters) within each sector. The example method for detailed assessments can also allow for identifying boundaries and the extent of contamination, and further investigation of areas with particularly high levels;
    - modeling of water, wind, or other deposition and transport patterns, and sampling to determine spread of contamination;
    - depth sampling to delineate the vertical extent of impacts and measuring area to estimate the volume of contamination to be addressed; and
    - TCLP or other testing as required by government regulations in order to determine hazardous waste classification, and legally allowable disposable methods.

Remediation Options

12. The Conceptual Site Model (CSM) will guide remediation decision-making. The type of hazardous waste and its exposure pathway(s) to the general public will indicate both the areas that should be prioritized for cleanup and the mode of remediation. The extent of contamination and exposure pathways, along with the available budget, will indicate the types of remediation that are feasible. Finally, the contaminants of concern will indicate the protections and equipment that must be provided for workers conducting the remediation.

13. An important consideration in addition to the CSM is the end-use plan for the site. The anticipated end-use of the site will also inform the types of remediation possible and any future institutional controls required to protect human health. For example, a residential area contaminated with lead could be graded and a geotextile barrier installed over contaminated soil, then a layer of clean soil placed on top. This would effectively block residents' exposure to lead-contaminated soil. However, there must be institutional controls, such as a soil management plan, specifying that people refrain from digging through the barrier without protection and/or proper treatment of removed soil from below the barrier. Another option could be to fence off an area that is contaminated so that no one can come into contact with the contamination. This would require periodic inspection and maintenance of the fence, prominent signage indicating the danger, and community education about the importance of respecting the barrier. Decision-makers will use end-use as well as the CSM and the available time and budget in choosing which remediation technique is preferable and possible.

REMEDIATION PLANNING

14. After the remediation technique is chosen, remediation planning can begin. Remediation planning will require a detailed work schedule covering:
    - Education - community education to prevent future recontamination and establish necessary institutional controls should be developed, in some cases this requires zoning changes and relocation of industry or residences by local government;
    - Equipment and Labor - hiring workers to remove the contamination and clean houses, streets, or other areas of exposure, heavy equipment may be required for digging and grading, in addition to hand tools – shovels, wheelbarrows, etc. In some cases this requires specially-trained and protected workers and highly specialized equipment;
    - Transport - transport of contaminated material to the final disposal area;
    - Construction - in some cases an encapsulation facility may need to be constructed at the site or nearby, or a transfer pad may be required to move materials to transport trucks for longer distance hauling;

- Monitoring - required for confirmation that contamination above acceptable levels has been removed or blocked from exposure, that effective worker and resident protections are being utilized, and that institutional controls have been implemented;
- Cover or Closure - if cover or closure of a site is necessary, clean fill material may be applied to the site, or in the case of on-site capping or stabilization, gravel, asphalt or other materials may be applied.

15. Site remediation can appear daunting and resource-intensive to governments that boast little experience or capacity in hazardous waste cleanup. Remediation is often feasible for a local or national government agency to undertake. A remediation plan should anticipate budget needs for one or two environmental consultants, equipment rental, day laborer wages, and the purchase of cover material as needed. Further detailed information about remediation is covered in Chapters 3 and 4 including budget estimates for various remediation techniques that governments can edit for their own calculations.

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Guidebook on Redevelopment Planning and Financing

Chapter 6

Chapter 6

Guidebook on Redevelopment Planning and Financing

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CHAPTER SUMMARY

1. The purpose of this TA is to address hazardous waste contamination in Indonesia and the Philippines, particularly to advise these governments on the potential to mitigate risks to human health while also planning for inclusive urban growth. This is the sixth chapter of the final report for the TA. The preceding chapter of this report outlined the process for controlling pollution and mitigating risks to human health as well as assessing contaminated sites and undertaking remediation planning. This chapter provides a perspective on

financing for remediation that uses redevelopment as a viable tool for governments to leverage in removing human health risks of toxic sites.

2. The breakthrough idea from this TA is that in many urban areas in low- and middle-income countries with polluted and abandoned or under-utilized sites, redevelopment planning could lead to investment by developers who would take on the cost of remediation in exchange for cooperation from government either through financial incentives, ease of permitting, or expedited approval of remediation and redevelopment plans. This idea, that remediation does not always require charity or government funding, should be considered by governments and site owners making decisions about polluted sites. In some cases, with cooperation from local government, a redevelopment plan by a developer could result in a faster remediation of a contaminated area than government intervention or a charity program alone could deliver.

3. The TA project team included key experts in brownfield redevelopment, urban development, urban planning, architecture, and development financing. They, along with the rest of the project team, assessed contaminated sites in both countries with potential for viable redevelopment investment, and then worked in depth on the site assessment, area demographics and development planning at a pilot site in each country. This chapter outlines on the process for redevelopment planning in general, to be used as a resource for countries looking to make better use of contaminated sites through urban redevelopment.

4. Urban redevelopment and revitalization can be undertaken by local government or even an active community organization in an effort to make more productive or more beneficial use of available but polluted lands. The process of Redevelopment Planning can be broken into five steps:

    - Site Selection
    - Site Assessment
    - Concept Development
    - Remediation Requirements

- Financial Feasibility
- Final Development

5. Each of these steps is highlighted and explained in the paragraphs below and in the checklists for redevelopment included in the appendices.

SITE SELECTION

6. In selecting the potential sites, it is important to have a working group of stakeholders involved that represent not only the team that will be leading the redevelopment process, but also government agencies, local advocacy groups, local leaders or leadership association, business groups, representatives of major institutions, housing and real estate professionals, candidate site owners and neighbors, and the public at large. Involving a core group of diverse stakeholders will begin building support for the project and will ensure that all potential objections or restrictions are voiced early on in the site selection process.

7. In some cases, landowners will be uncooperative, unavailable, or unknown. This is not a reason to completely ignore a site that has high potential. It is common for owners of contaminated sites in particular to be hesitant about allowing site investigations or documentation of pollutants at a site associated with their name or business. Rather than forcing owners legally or through threat of government action, it is advised that the development planning progress normally and that the owners continue to be invited and informed about the ideas and potential for the site. It is likely that in the course of the redevelopment planning, as the potential for selling the site or taking on the development project himself or herself becomes more attractive, the initial concerns of being held liable are no longer as important to the owner. The government can help in this regard by offering assurances that the owner will not be prosecuted or further fined if they cooperate with the remediation requirements or if they sell the property. Alternatively, surrounding land owners may begin to cooperate and get onboard with development or begin to profit from the project and then the reluctant owners will see the value of participating. While the government in most cases has legal options to force a clean-up due to high public health risks, working to remediate a site through redevelopment makes it possible to encourage action positively through market forces. In cases where there is no clear owner of a site (i.e.

community property), or it is a government property, the local government may decide to move to take ownership, sell the property to an interested developer, or organize a public private partnership to work on the redevelopment.

8. After a working group is selected for the site selection process, the list of candidate sites can be finalized and the review process can begin. At the early stages of site identification, the team will conduct field visits to the site (if there is access), explore the surrounding area, and collect information on potential contamination and or exposures to the population, estimate the population at risk (if this data has not already been collected), identify site boundaries and approximate size, and observe transportation options and land uses in the areas surrounding the site.

9. The initial field visit data will then be supplemented with background research on each site. In particular, it is important to note site ownership, size, current uses and zoning, and site history including any accidents, flooding, pollution, or other issues. Much of the data can be gleaned from the public or working group members, other information may be collected at the local government office.

10. Next the team should gather information that would affect redevelopment opportunities at the site. This requires data on land uses, public policy, population, and economic growth in the surrounding area. In urban areas, characteristics that affect redevelopment might include:

    - Physical characteristics such as the shape of the site, ownership of the site, transportation access to the site, availability of infrastructure (water, electricity, sewers), and subsurface conditions
    - Economic and fiscal characteristics of the local area such as the available workforce, recent investment in the area, fiscal (tax) incentives for redevelopment and or remediation, and economic benefits that might be created by the redevelopment
    - Public policy or attitude of the local, provincial and national governments regarding remediation of hazardous wastes and urban redevelopment, i.e. officials aware of public health issues, supportive of cleanup, and promoting modern land use controls

- Existing land use patterns and how they serve the local population, for example open space and quality of life, the need for neighborhood improvements (e.g., housing, roads, drainage) and the availability of other potential sites for redevelopment

11. Once all the data has been collected, the stakeholder group can begin to compare the sites in order to make a selection. This requires a rating system with key decision-making factors and relative importance of each that must be agreed on by the stakeholders. A matrix can be developed with each selected characteristic to be screened for and a suggested range of importance (from least (1) to most (3) for example). The matrix will allow assessment of the potential to redevelop each site by rating the difficulties or constraints to redevelopment and the level of opportunity. Suggested ratings could range from 0 (significant constraint to redevelopment) to 4 (significant opportunity for redevelopment) for example. The sites that have a higher potential for redevelopment can be filtered from the list by multiplying the importance of the site characteristic (1, 2 or 3) by how that characteristic would affect the potential to redevelop the site (0, 1, 2, 3, or 4). After the results for each site are summed, the site rating can be compared. The results of the matrix exercise will likely indicate 1 or 2 top sites that can then be discussed among the stakeholder group and a redevelopment site can be chosen. Top scoring sites that are not chosen may be saved as potential redevelopment projects for the future.

SITE ASSESSMENT

12. A detailed site assessment will be conducted after the redevelopment site is chosen. The working group for the next phase of the project will likely be a subset of the original site selection group with one or two additional experts added to the group. In assessing the site for redevelopment, the team should spend time physically exploring the site and the surrounding areas as well as interviewing people, and gathering data from local government, developers, real estate agents, construction companies, and loan providers. Detailed data must be collected including:

    - Geographic Characteristics: mapped boundaries, precise size, presence of wetlands, steep slopes, water bodies, depth to ground water, vegetation, developed area, location, extent, type, and depth of contamination

- Conceptual Site Model: full delineation of all contaminants of concern and evaluation of potential exposure pathways and potential interventions (this may have already been completed)
- Infrastructure: potable water, sewage, electricity, utilities required for businesses, transportation access
- Ownership: presence of businesses or residences and known owners
- Use: prior and current uses and condition of current uses
- Physical Characteristics: Presence of historic and other key features or structures
- Constraints and Opportunities to development on the site

13. In order to research the area in which the site is located, a Primary and Secondary Study Area may be delineated. A Primary Study Area, depending on size of site to be redeveloped, is usually defined by a radius of from 200 to 500 meters from the boundary of the redevelopment site. Physical barriers, such as a large water body, steep grade change, or a highway or railroad that allows no access across may also define the area. A Secondary Study Area may need to be defined, depending on the size of redevelopment site. If a Secondary Area is used, it would likely be defined by a radius of from 500 to 1,500 meters from the boundary of the redevelopment site. Physical barriers may reduce the size of the secondary study area. Once these Primary (and potentially Secondary) areas are identified, researchers can assess the geographic characteristics, existing infrastructure, owner profiles, land uses, physical characteristics, and potential constraints or opportunities within that zone as they reflect on the identified redevelopment site.

LAND USE ASSESSMENT

14. For the Primary Study Area, the team should assess existing land uses using field survey, aerial maps and secondary sources (for example Planning Department documents) as relevant. The land use information to be collected includes:

- low- and medium-density residential uses
- multi-family and other high density residential uses
- institutional uses (schools, religious institutions, government offices, hospitals, prisons, etc.)

- parks and other publicly accessible recreational uses
- commercial uses (as appropriate distinguish among small, medium and large retail uses, office buildings, hotels, and “heavy” commercial uses such as sales of equipment related to construction)
- transportation facilities (e.g., street system, highway system, traffic conditions
- presence and condition of public transportation, if relevant: water borne transportation and airports.)

SITE CHARACTERISTICS

15. The team should also Identify and map site characteristics that would be relevant to redevelopment potential and contribute to neighborhood character in the study area. These may include:

    - key resources
    - historic buildings or tourism sites
    - natural resources
    - major institutions

16. Additionally, the team should research public planning and zoning policy affecting the site, and any problems that could constrain or prevent development, for example lack of sewer, water, power, access or any conflict with land use policy.

17. If a Secondary Study Area is also being included, the team should map existing generalized land use patterns, with a focus on recent or anticipated land use changes, particularly for larger developments and identify key resources, e.g., historic buildings, natural resources, major institutions, and other features that contribute to neighborhood character in that study area as well.

Economic Opportunity

18. In order to assess sites for redevelopment opportunity, it is important to know the potential for supporting a housing, retail, business park, or industrial zone development. The team should review key population, housing, and employment data in the primary and secondary study areas. Each of these key research areas is highlighted below and included in the

checklists in the appendices. This data will inform the redevelopment planning and will be used to determine the value of various land uses, the likelihood of success, the costs of the development and the anticipated return on the investment.

Population Data

19. Residential population data for the closest year available is important; as is data for smaller areas (e.g., villages, census tracts) as available. Ideally, the team can also characterize the population by number of households, gender, age, household size, ethnicity, education, income, work force, and types of jobs that residents hold, and any historical trends or future predicted trends (demographic shifts).

Housing Data

20. For residential data, the team should assess housing conditions in the study areas: number of units, vacant versus occupied rates, presence of informal units or settlements, the type, size, age and condition of the housing stock, the percentage of residents who rent or own, and the tenure of ownership.

Employment Data

21. It is important to assess employment data for the study areas; if not available, employment data for a larger area (city, province, or region) relevant to the site can be used. The team can use this information to identify major employment sectors such as manufacturing, business, educational or social services and map the locations of major employers that would impact future development opportunities, such as:

    - major businesses and commercial developments (e.g., manufacturers, service, supply or transportation related businesses, shopping or major retail outlets, office buildings)
    - large institutions including hospitals, clinics and other health care, universities, colleges and schools
    - cultural resources such as tourist attractions or places of worship

Demand for Goods and Service

22. The redevelopment team also should assess the demand for additional goods and services in the study area based on changes in population size and demographic characteristics, observed land use patterns, employment characteristics, and income and/or spending characteristics. In addition, recent land use trends and/or signs of recent private capital investment or public infrastructure improvements can be used to identify and evaluate potential development pressure on the redevelopment site by national and/or provincial socioeconomic trends. Local developers, real estate agents, construction companies, or loan providers can be valuable sources to indicate these types of trends.

CONCEPT DEVELOPMENT

23. In order to frame ideas and alternative concepts for redevelopment, the project team should create a list of goals and objectives for development of the site. The data gathered in the site assessment can inform the development of concepts that are in line with local trends and regulations, economically viable given the local housing and business market, and desirable by local stakeholders. Creating a list of goals and objectives for redeveloping the pilot site may require more than a single meeting to build consensus and reach agreement. Where possible, consensus-building meetings should be held in the vicinity of the project site and ideally in an open forum where local stakeholders feel comfortable. There may be more than one meeting held depending on site size and availability or proximity of government decision-makers.

Anticipated results of redevelopment

- An economic benefit for the study area(s)
- Increased property values
- Net new property, personal income, and business tax revenues for the government
- An improved quality of life for the community

24. It is important that the planning phase be undertaken in concert with stakeholders from the vicinity of the pilot site, both residents and business owners, as well as with local, provincial and/or national government officials who are aware of issues related to contamination on the pilot site and the need to remediate these conditions to restore public health and safety. Government officials should be encouraged to share any knowledge of major improvements proposed or planned for the area, such as new sewers, water or electric service or transportation improvements such as new roads or transit systems. Local residents and business owners should be encouraged to share their vision of the future in and around the pilot site.

25. The redevelopment team should approach the planning meeting(s) with an open mind. In order for buy-in and community support, it is important to gather feedback and ideas from the stakeholders, not present already formulated plans to them for approval. The stakeholders may present new interesting ideas that the team had not considered, raise additional concerns that should be investigated, or identify other trends in the area. The meetings can include guided discussions, brainstorming or visioning sessions, presentations from other cities on successful redevelopment projects, and presentations by government, public health specialists, remediation specialists, and if relevant, industry best practices or alternative livelihoods specialists.

26. After the planning meeting(s), initial redevelopment concepts can be drafted. Redevelopment concepts should be appropriate for the size of the site and sensitive to surrounding land uses to the greatest extent possible. Local zoning will guide the types of land uses that would be appropriate for the pilot site. For example, a heavy manufacturing plant would not be appropriate for a pilot site surrounded by residential dwellings. Likewise, consideration should be given to the location of transportation routes and types of transportation modes in the vicinity of the pilot site. For example, the availability of public transit close to the pilot site would increase its suitability for denser types of development such as residential subdivisions, labor-intensive business or industry and tourist attractions. Redevelopment concepts should not create new or undue burdens on pedestrian safety and vehicular traffic in the vicinity of the pilot site. Any conflicts between the plans under

consideration and zoning and land use policies and public plans should be identified. Zoning changes and other modifications to land use controls and policies could be recommended and further pursued.

27. Redevelopment concepts also should respond directly to population and land use trends in the study area(s). For example, residential development could be recommended where there are clear trends in population increase. Residential development should be geared to the housing demand (or shortage) generated by households already living in the study area(s) or by new households moving into the area. Business and commercial establishments could be recommended where there is demand either from increased earnings or proximity to natural resources or special labor skills. Any recommended business and/or commercial development should be sensitive to the human and natural environment in the area. A development plan could also respond to demand or shortages identified in education or health care, cultural resources, or open space or recreational sites.

28. Additionally, redevelopment concepts should take into consideration the contamination at the site, the remediation methods possible, and any land use restrictions that may result from the remediation. For example, contamination that will be excavated and then put into a landfill built at the site would have restrictions on digging or building, requirements for drainage or venting systems, or would limit the amount of buildable space and adjoining land uses at the site. The remediation will be considered more fully once a concept has been chosen, but if the anticipated remediation is going to clearly put limits on future development it must be taken into account early on in the process to avoid unnecessary repetition of the process.

29. Overall, the redevelopment planning process should result in one or more concepts that provide: (1) an economic benefit for the area by creating jobs or providing housing, goods, or services, (2) increased property values, (3) net new property, personal income and business taxes for the various branches of government, and (4) improved quality of life for all residents and employees in the area.

30. Once development goals and objectives are agreed on and development concepts elaborated, appropriate members of the project team should draft at least two alternative plans for redeveloping the site. These plans should include one or more land uses designed to achieve the stakeholder goals and visions identified in the prior meetings with the project team, community and government officials. The conceptual plans should be produced with enough detail to easily demonstrate the various components to stakeholders who might be unfamiliar with plans and architectural drawings.

31. At a minimum redevelopment plans should show:

    - boundaries of the site and adjacent land uses
    - land coverage and massing of buildings on the pilot site
    - proposed occupancy or land uses in each of the buildings
    - vehicular and pedestrian access to and through the site
    - location of parking
    - location of open space (if any)
    - drainage plan and/or features to control flooding and urban runoff
    - detailed information on the total amount of gross building area, building area by use number of parking spaces

32. A simple sketch of each draft plan should be prepared to provide stakeholders with a three-dimensional picture of what the redevelopment would look like. However, architectural details such as design of facades or materials to be used in construction are not required at this point; neither is it necessary to provide costs estimates at this point.

33. After the sketches and concepts are available, stakeholder groups (residents, businesses, government officials) should have an opportunity to review and comment on the draft plans at a public meeting and potentially also through a series of presentations and reviews in a public space meant to attract passers-by (at a local transportation hub or shopping center for example). The project team should consider the comments, revise the conceptual plans and incorporate suggested changes, where appropriate. The products from the community

review meeting(s) should result in one or two development plans that are at least satisfactory to the community and other stakeholders.

REMEDIATION REQUIREMENTS

34. Once the "draft" development plans are agreed upon, the costs of implementing each plan must be estimated. At this point, standard industry costs for appropriate types of building construction, required infrastructure, and expected labor could be used to generate a "ballpark" estimate of overall costs. This initial estimate should be made *without* regard to remediation of hazardous materials that may be present on the site.

35. A separate assessment of potential remediation options and an estimate of remediation costs should be provided by engineering and environmental professionals. Details regarding this process are outlined in Chapter 5 – the Guide to Remediation Planning.

36. It is important to do the remediation and redevelopment planning in concert because different levels of contamination call for different remediation methods, future land use may be impacted, and different redevelopment concepts will require different levels of remediation. For example, building an apartment complex or a kindergarten would require a very different level of remediation than an industrial zone or a parking lot. For the purpose of overall project cost estimation, adding remediation costs to development costs provides a summary view of the magnitude of the project. This initial estimation is likely to be quite high as estimates are meant to be conservative and the initial estimate will not have any subsidies or incentive programs included. An initial, high estimate should not discourage the project team. There are several alternatives for addressing remediation costs so that they don't derail redevelopment of the pilot site. Financial feasibility and commonly used financing strategies are detailed in the sections below.

FINANCIAL FEASIBILITY

37. An important component of development and remediation cost considerations is a clear understanding of the benefits of the redevelopment project. Will it eliminate or contain contamination from hazardous materials and threats to public health and safety? Will it

provide new jobs and to what extent? Will it provide new housing resources and to what extent? Will it provide necessary services that cannot be achieved at another site? Will it create new cultural resources, open space or recreation that will elevate the quality of life of residents and employees in the study area(s)? While the answers to these questions may not be included in the financial analysis, they are key considerations in the decision-making process.

Anticipated remediation costs could be absorbed by developers if the redevelopment of a site can produce income over a reasonable period of time and sites to be remediated may attract private investment to what was previously only thought of as a government or charity-funded remediation project.

38. In the target countries of this TA, all previous remediation efforts have been made from the viewpoint of public safety and government responsibility rather than in consideration of the economic value of the site if redeveloped. An ideal outcome of this TA is that governments can look at contaminated, underutilized sites as potentially economically viable on their own – with a view that remediation costs could be absorbed by developers if the redevelopment of a site can produce income over a reasonable period of time and that sites to be remediated may attract private investment to what was previously only thought of as a government (or charity) -funded remediation project.

39. Estimating the economic benefits of the redevelopment plans will depend on the statistical resources available for such an analysis. The project team should check with appropriate government offices, most likely economic development officials at the national level, to see if econometric models are available for estimating economic impacts. If econometric models are not available or are not applicable to the redevelopment proposed for the site, project team members should conduct enough research to estimate the economic benefits that would be generated by the redevelopment plans. This research may require sampling economic uses similar to those recommended for the redevelopment site in an attempt to predict the number of jobs that would be created. For example, interviewing the manager of

a bank, retail store, restaurant, shopping center, factory or clinic to identify the number of employees and the wage scale.

40. At a minimum the project team should estimate the following:

    - value of construction of all components of the development plan
    - number of jobs that would be created at the site both during construction and during annual operation (one stabilized year) of the activity on the site
    - income that would be earned by employees on the site both during the construction phase and during annual operations on the site
    - taxes that would be paid by individuals working on the site during the construction phase and annual operations (based on personal income)
    - taxes that would be paid by businesses and corporations located on the site during the construction phase and annual operations (based on materials, sales or revenues)

41. While it is beyond the purpose of the financial analysis to estimate the economic value of intangible benefits such as the addition of open space in a neighborhood or improvements to public health and safety, it is still important to describe how such changes would improve the quality of life of residents and employees in the area, as well as the competitive position of certain businesses and services in the existing area. In the absence of adequate data and statistics to quantify the economic benefits of the draft redevelopment plan, a qualitative assessment of how the plans would affect the economy and quality of life should be undertaken.

Revenues and Operating Costs

42. Comparing development costs and remediation costs presents only part of the feasibility picture. To better assess the feasibility of implementing the plan, the project team also should estimate the amount of revenue that would be generated by the various components of the planned development. Industry and/or government publications should be consulted to determine the rents or sales prices that could be charged for occupying or purchasing facilities developed on the site. Revenues should be projected for a 10- or 20-year period including a reasonable allowance for inflation. Similarly, operating costs should be projected

for the 10- or 20-year period. Subtracting operating costs from operating revenues in each year will yield net operating revenues (before taxes, fees and debt service). Finally, the net present value (NPV) of the net operating revenues should be calculated. Comparing overall costs to the NPV of the net operating revenues (net cash flow) will indicate the financial feasibility of the project without any adjustments for remediation activity.

43. Measuring the economic and social impacts of the redevelopment plan will indicate how the remediation costs could be shared by the public sector alone, by the entity responsible for the contamination, by the private sector developer, or by a combination of two or all of the involved parties. In a *Public-Private Partnership* the public sector (government) typically pays for improvements to property that will benefit the public, particularly if such costs are prohibitively high and threaten the implementation of a redevelopment project that has broad public approval. For example, the government may pay for the remediation of a contaminated site because it will remove a threat to public health and safety, while permitting the private sector to invest in the redevelopment with the potential to create economic benefits and a reasonable return on its investment. Government participation in the implementation of a redevelopment plan could often be the difference between a project being financially feasible or not for private investors.

44. If the public sector is not willing to participate in the remediation of a contaminated pilot site, or if its participation would significantly delay the implementation of a redevelopment project, a private developer may use his or her own equity to remediate a site. In return for assuming the financial burden and risk of remediating a contaminated site, the private sector may seek to recover the expense in remediating a site through tax relief (such as moratoriums on paying sales tax on construction materials or property taxes for a number of years). The private sector may also seek to balance the additional cost of remediating a pilot site by applying for low interest loans from the government, where available. While it is not necessary, cooperation from government can make this option more attractive for potential developers and can make a remediation project more likely to be successfully completed. The financing options that were outlined for the pilot sites in each country as

part of this TA did not take any incentive programs into account and both development options were still shown to be potentially profitable investments over a 10 year period.

FINAL DEVELOPMENT

45. After financial feasibility and economic benefits are assessed, the project team should return to the stakeholders again with a more detailed picture of the development options. Meeting with the stakeholder group, the project team should facilitate the process of creating a final plan for the site. This process may require more than one meeting to achieve a consensus among the stakeholder participants, and may also require the merging of preferred components in each draft plan into one final plan. If budget and time permit, the project team should create a three dimensional rendering of the finished plan. Detailed drawings are not required but helpful as a graphic aid in presenting the final plan to the stakeholders. Cash flow estimates and financing strategies should be adjusted and carefully explained as necessary. Where possible, the public contribution to a public-private partnership should be elaborated and the steps and timetable required to secure the public investment should be identified. Ideally, local government would be onboard with the plan and excited to partner with potential investors, seeing redevelopment as a positive opportunity for the otherwise contaminated and under-utilized site.

46. The final plan can then be shared with potential private sector developers, investors and financial institutions. The project team, with participation of the stakeholder group, should identify likely participants in the private sector and present the plan, which should be portrayed as a “template” for redeveloping the site. The project team can gauge and evaluate the level of interest on the part of the private sector and tweak the presentations as needed. It is at this point in the process that the project team should hand over the implementation to a stakeholder working group that will commit to working with local government and developers to implement the plan. Further negotiations among the interested parties (government officials, private developers and the stakeholders) should be managed by the stakeholder working group until such time as a public-private entity is formed to implement the plan or until a developer has committed to the project, negotiate

with owners of the pilot site, and work to form their own strategies for financing the redevelopment.

47. A primary problem in addressing contamination in communities such as the ones selected as pilot projects in this study is the cost of cleanup. Land that could be productive and important in a community ends up sitting abandoned or used inefficiently because it is polluted and seen as too expensive to address. Even when communities or governments mobilize to respond to a serious pollution issue, it often ends up stalled or incomplete after the costs are calculated and key stakeholders become discouraged that it is unaffordable. At worst, people continue living and working on contaminated sites and slowly poisoning themselves and their children. This project seeks to respond to that concern by providing guidelines for communities to use to identify sites that could be redeveloped successfully and become draws for developers. These redeveloped sites will generate income, either through housing sale or rents, through retail, industrial, or office space rents, or through government subsidy for local open space or quality of life projects. This is an exciting possibility for governments facing the challenge of polluted land that will require a hefty budget to remediate. If a developer can be shown that the land could be redeveloped and revitalized and then make enough money to re-pay the cost of remediation, there will be a shift in how polluted sites are viewed. While the costs of remediation may be staggering, it is important to always compare that number with the potential earnings of a site after redevelopment. The results of the project team's work at the pilot sites are encouraging as examples of how polluted, under-utilized sites can be remediated and redeveloped and then provide returns on the investment. The details of the pilot site projects in both Indonesia and the Philippines are covered in the Strategic Urban Redevelopment Plans in Chapters 3 and 4.