

Weed Free Aggregates for Land Managers



Introduction



Johnson Grass. NPS Photo

Non-native invasive plants displace native plants and crops, deplete water, increase wildfire severity and frequency, decrease visibility along right-of-ways, degrade pastures, decrease timber yields, degrade wildlife habitat, and inhibit recreation. Land managers control invasive plants to reduce the environmental and economic damage that invasive plants cause. Treating invasive plants over a large area is expensive and often impossible. However, prevention of invasive plant introduction and establishment is the most cost-effective alternative.

Aggregate quarries are high quality habitat for invasive plants and are the source for many invasive plant infestations, especially in transportation corridors and construction sites. When contaminated aggregate is used, invasive plant propagules transplant from one high quality disturbed habitat to the next. Land managers can save thousands of dollars on treatment by preventing the introduction of invasive plants by buying weed-free aggregate. Weed-free aggregate is material purchased from a quarry that has been inspected and certified weed-free. An inspector examines the quarry to determine the likelihood that saleable material leaving the quarry does not contain invasive plant propagules. Upon successful inspection, the inspector issues a weed-free aggregate certificate.

This document provides guidance for land managers interested in starting a weed-free aggregate inspection program. Currently, California does not have a statewide inspection program although several public agencies (e.g. Yosemite National Park, Sequoia-Kings National Park, US Forest Service – Lake Tahoe Basin Management Unit) do inspect nearby aggregate pits and issue weed-free aggregate certificates.

These certificates are shared between land managers. As more land managers join the program, it reduces the cost of inspections. Additionally, the certificate increases product visibility and demand and becomes a marketable tool that highlights the “value-added” to the product.

The demand for weed-free aggregate will increase as land managers realize the cost-savings of purchasing weed-free aggregate as opposed to incurring the cost of treatment. The voluntary collaboration of land management agencies and quarries creates a market driven solution to invasive plant management problems.

Quarries have financial incentive to participate in an inspection program, but they may not have the financial resources or knowledge base to develop an effective invasive plant abatement program. Therefore, the inspector serves dual roles as both inspector and educator. The success of this program hinges on the collaboration between inspectors and quarry managers to develop an integrated pest management program for each quarry. Inspectors work with quarry managers to develop invasive plant identification skills, and provide educational materials to guide managers to develop a successful program.



Klamath NF-- Dyers Woad on Gravel. USFS Photo



Case Studies

- At Great Smoky Mountains National Park in Tennessee, park staff began suspecting aggregate as a invasive plant source after seeing weedy white sweet clover and coltsfoot growing out of stockpiled winter sand. The winter sand was used on the highway and the next year new infestations of white sweet clover and coltsfoot were found scattered along miles of highway.
- Land managers discovered the highly invasive plant, dyers woad, growing along five miles of road in Klamath National Forest in northern California. Staff manually treated the infestation, but it continues to spread despite all efforts.
- Aggregate from gravel pit infested with black henbane was used to resurface a road in Sublette County, Wyoming on natural gas field roads. New henbane infestations soon popped up along the roads and spread through the region.
- Staff at Golden Spike National Historic Site in Utah, noticed new infestations of dyer's woad growing along miles of railroad grade after the park accidentally imported contaminated gravel to shore up the railroad grade. They had to bring in a specialized National Park Service invasive plant treatment team to treat the problem.
- Emergency repairs for several miles of roadway required the import of fill dirt to stabilize the road edge, after a large flood in Yosemite National Park washed away the road. The fill dirt was contaminated and the following season many new invasive plant infestations sprung up. Yosemite spent hundreds of thousands of dollars to clean up the worst of the most invasive plant species, but many of the highly flammable annual grasses and other invasive plants remain today.

Sublette County (WY), Great Smoky Mountain National Park (TN), and Yosemite National Park (CA) now inspect aggregate before importing it to prevent paying for the costly treatments that followed these simple mishaps. Agencies across the West have instituted gravel pit inspections in the past fifteen years. The North American Weed Management Association (NAWMA) developed inspections standards in 2007. The U.S. Forest Service (USFS) Lake Tahoe Basin Management Unit has been inspecting gravel pits since 2003, and annually provides each operator with a letter authorizing or denying use of their products for Forest Service projects in the Tahoe Basin. Yellowstone National Park has been inspecting pits since 2003 and now inspects over 50 pits. This program builds upon those programs and provides the resources necessary to land managers and quarry managers looking to start their own program.

Establish a Program/ Contract Language

In order to establish a weed-free aggregate program, involve all people who may participate. This collaborative program includes not only the quarry managers, but also people who purchase material, write the contracts, and the engineers or landscape architects who design the project. When all parties understand the importance of purchasing weed-free aggregate, place specs in the contract. As follows is an abbreviated example from Yosemite National Park of contract language:

“All imported material from Contractor-located sources must be certified to be free from noxious weeds or invasive plant materials and other deleterious material before entering the project site at the start of any contract with ground disturbing activities and/or construction season. The site and/or quarry must be available for review between the months of May and August, as that is the primary time when invasive plants are presentable and recognizable.”

Submit a list of sources to be inspected within 2-weeks after the award date. In addition to the source, name and location, submit potential mitigation measures to be considered during the inspection to make the source weed-free. Ensure list includes the end use and any temporary storage requirements of those materials. The CO, in consultation, will inspect sources of materials that pose a risk, either by their end use or storage requirements, of allowing invasive non-native plants (noxious weeds) to establish.



Washing equipment. NPS Photo

Contract Language, continued

Materials may be rejected if non-native invasive plants are present at the source and seeds could be present in the material. An inspection report will be furnished within 21-days after an inspection listing the status of the source and any mitigation measures that would need to be accomplished prior to use.

Ship import material directly from the source to the project site without intermediary storage or staging. Cover (tarp) loaded trucks when directed by the CO for safety or environmental concerns. No direct compensation will be made to the Contractor for covering truck loads. Materials must also be transported and stored such that they will not acquire invasive non-native plant seeds from adjacent vegetation. The CO, in consultation with the Park, will decide if a non-native plant is potentially invasive based on its presence on the Federal or California noxious weed list, the California Invasive Plant Council's weed list, or other sources of weed information.”

Non-native invasive plants, or noxious weeds, are species of plants that do not naturally occur in a particular area and have the potential to spread from their point of introduction into surrounding areas.

Obtain clearance or eradicate non-native plants by:

1) Provide certification by a county extension agent, agronomist, or other qualified invasive species expert that the source is free from exotic plants; or

2) Notify the CO at least 2 weeks before beginning operations or starting crushing to allow for investigation for exotic plants. If exotics are found, the CO will determine if the upper portion of the source will need to be stripped or sprayed with a herbicide approved by the CO. If spraying is required, provide

a licensed operator to spray according to applicable state regulations. Do not spray any herbicides until approved in writing by the CO. Spraying or stripping of material does not necessarily constitute approval.

3) If exotic plant clearance is not obtained, heat all material to 300 degrees Fahrenheit to ensure sterilization of any exotic plants before delivery of uncertified material. Do not stockpile the heated material outside the park boundaries prior to delivery. These requirements are waived if the contractor uses a source that meets the requirements stated in items (1) and (2) above.”

While some quarries might have weed-free material available immediately, many quarries will need help developing and implementing a weed management plan before receiving a passing inspection. It is the inspector's role to assist quarries in the development of an integrated invasive plant management plan.

Frequently Asked Questions

Why are quarries weedy?

Quarries are highly disturbed areas due to the nature of the site. Disturbed areas are ideal habitat for many invasive plants.

Why should we use weed-free aggregate?

Invasive plant prevention is the single most cost-effective alternative to treating noxious plants. Contaminated aggregate used in road construction/maintenance is a primary vector for invasive plants spread. When contaminated gravel is used, the infestations can extend for miles.

Why should we join the weed-free aggregate program?

An agreement between land management agencies and companies to purchase weed-free aggregate creates a market driven solution to invasive plant prevention problems. A shared program between land managers and suppliers strengthens product visibility and demand, thereby indirectly boosting financial incentive for suppliers to participate.

How do invasive plants transport to my project site?

Invasive plant seeds blow around the quarry and land on recently mined material. The contaminated aggregate is then directly transplanted at the project site into another disturbed area. Invasive plant seeds and propagules can also be transported around on equipment and vehicles.

Is weed-free aggregate actually weed-free?

No. There is no guarantee that weed-free aggregate is actually weed-free. This program greatly reduces the probability of contaminated aggregate being imported by working with quarry operators to identify and treat invasive plants. Inspectors work with quarry operators to manage invasive plants, and to manage stockpiles to reduce risk of contamination.

Can federal agencies preferentially purchase weed-free aggregate?

Yes. Federal agencies can preferentially purchase products that reduce the probability of spread of invasive plants if the agency deems the benefit of purchasing weed-free material reduces the probability of the spread of invasive plants, even if weed-free aggregate is not the lowest bid. (Clinton Executive Order 13112).

Why should I ask quarries to treat invasive plants when I can treat myself?

It is far more efficient and cost-effective to treat small infestations at the source. If contaminated aggregate is used, the infestation along roadsides can be miles long.

Are some materials weedier than others?

Yes. Some materials are more likely to have invasive plants than others. The more processed a material is, the less likely it will have invasive plant seed. Processing may sort, crush, heat or encase invasive plant seed. Material is listed from most likely to least likely to have invasive plant seed.

- Soil
- River rock, cobble, uncrushed material
- Crushed river rock
- Crushed bedrock
- Concrete
- Asphalt

Are some quarries weedier than others?

Bedrock quarries tend to be less weedy than quarries mining loose material, like in flood plains. Often in flood plains, the water table is close to the surface and so quarry operators must keep moving the active pit after hitting water. This increases the size of the pit and increases the amount of invasive plant habitat. Bedrock quarries tend to have a much smaller footprint and therefore often less weedy.

What areas in the quarry are most likely to have invasive plants actively growing?

- access roads
- perimeter
- stock piles
- standing water
- overburden storage
- equipment and vehicle parking

What areas in the quarry are most likely to contaminate the aggregate?

- access roads
- active mining areas
- stock piles
- standing water
- reclaimed land

What other factors could also contaminate aggregate?

- neighbors
- water source
- prevailing wind
- stockpiling aggregate outside the quarry

How much will this program cost?

Costs associated with the program are small, especially when compared to costs of treatment. The cost of aggregate may increase slightly if there are significant invasive plant control efforts required by the quarry. There is the additional cost of an inspector’s time to go to the quarry. Agencies could share certifications and inspectors, thereby reducing the cost.

How do we train an inspector?

Attend a workshop or go with someone who has previously inspected quarries. Use the materials available in this packet to guide an inspection.

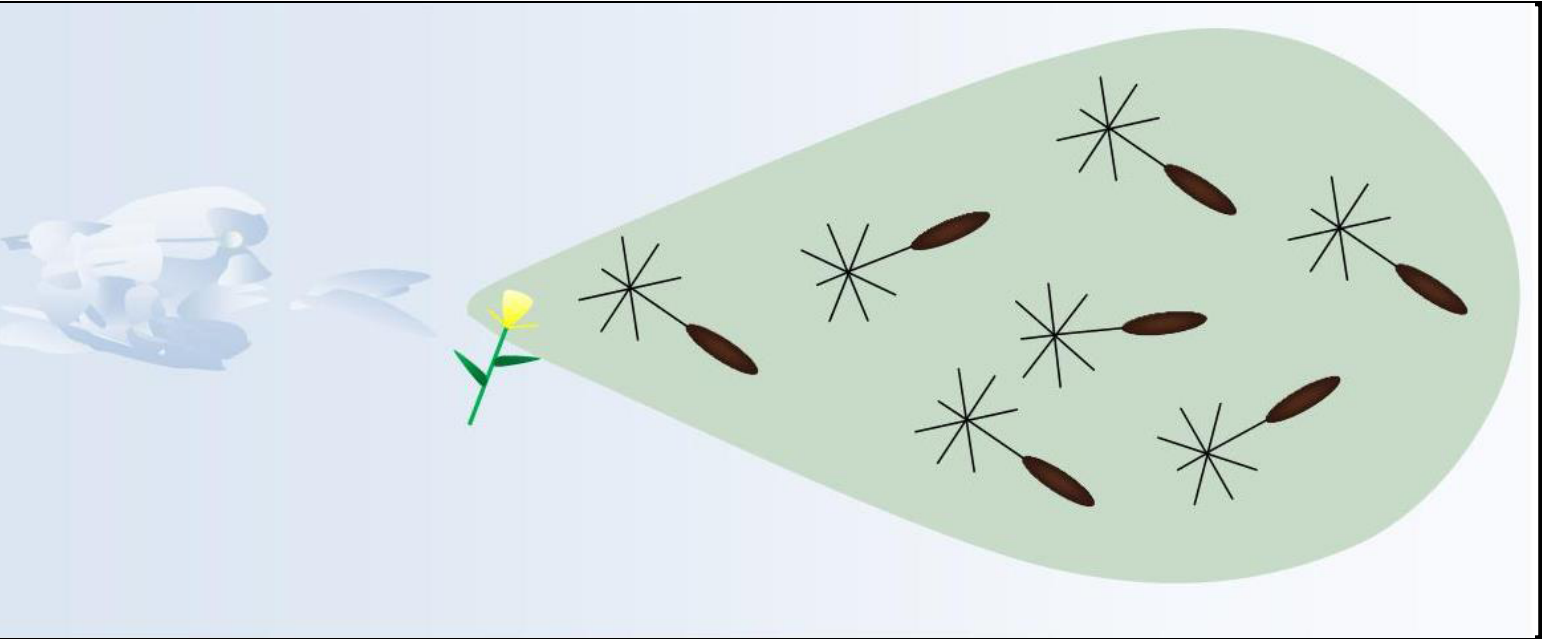
What questions should I ask quarry operators?

1. What is your water source?
River or lake water could have invasive plant propagules or aquatic invasive plants in it
2. Do you have a current invasive plant management plan?
3. How long does aggregate sit in stockpiles?
They longer aggregate sits in stockpiles, the higher the probability of contamination
4. How much longer are you in operation?
Quarries closer to reclamation may need to step up treatment programs, while new quarries might have a smaller seedbank.
5. How is organic material filtered out of the aggregate?
6. Is the pit continuously reclaimed with overburden as the quarry expands, or does the overburden sit until mining is finished?
7. Did any of this material come from a different quarry?
Material en route to a construction site may become contaminated. This is much more likely to occur when material is staged outside of a project site. Additionally, quarries may purchase material or stage material from another quarry.

Seed Dispersal

Most invasive plant seeds fall close to the parent plant, some of the seeds disperse further from the plant, and a few seeds fall very far from the parent plant. Seed dispersal can be either 1) directional, or 2) evenly distributed around the parent plant.

- 1) Directional distribution occurs when wind blows seeds away from the parent plant.
 - Seeds spread within a cone away from the parent plant instead of a circle.
 - Plants on a slope spread their seeds further because gravity pulls them down.
 - Humans pick up seeds and disperse them along roads, trails, or developed areas.
 - Animals drop seeds along a corridor
- 2) Seeds spread evenly in a circle away from the parent plant when outside factors do not influence seed distribution directionally. For example, lupine seeds burst out of the pods in random directions and distribute close to the parent plant.



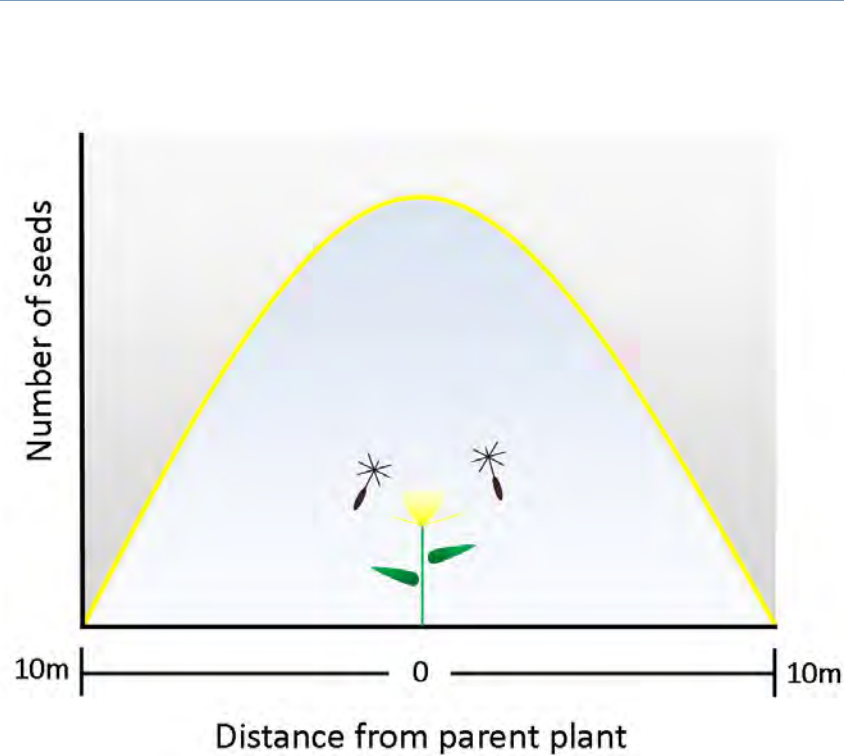
Wind disperses seeds away from the parent plant and can contaminate large areas with seed.

Multiple factors can combine to increase the dispersal distance of a seed. If the seed has a pappus, it travels further than a seed lacking a pappus. The distribution may increase again if the plant is at the top of a slope, and so the dispersal circle increases. Seed characteristics that increase seed dispersal distance:

- 1) Hooks, spines, burs
cling to animal fur or clothing (e.g. cheat grass)
- 2) Edible
animals eat then spread seeds (e.g. blackberry)
- 3)Pappus, wings
parachute-like structure helps seeds catch the wind (e.g. dandelion)

When parent plants go to seed, any seeds that do not germinate form a seedbank and contaminate a site for years. It usually takes years of treatment before a site is no longer contaminated.

Equipment and vehicles transport invasive plants not only within a quarry, but from quarry to quarry. When contaminated equipment comes from a weedy quarry, it can easily carry and subsequently spread invasive plant seed. This happens when seeds fall off the vehicle, or especially when contaminated aggregate or fill is transferred between quarries. Washing equipment greatly reduces the probability of equipment spreading seeds. Also monitoring all outsourced material for invasive plants will reduce the risk of them spreading on the property.



Most seeds disperse close to the parent plant, but some can travel long distances based on outside factors.

Probability of Invasive Plant Occurrence

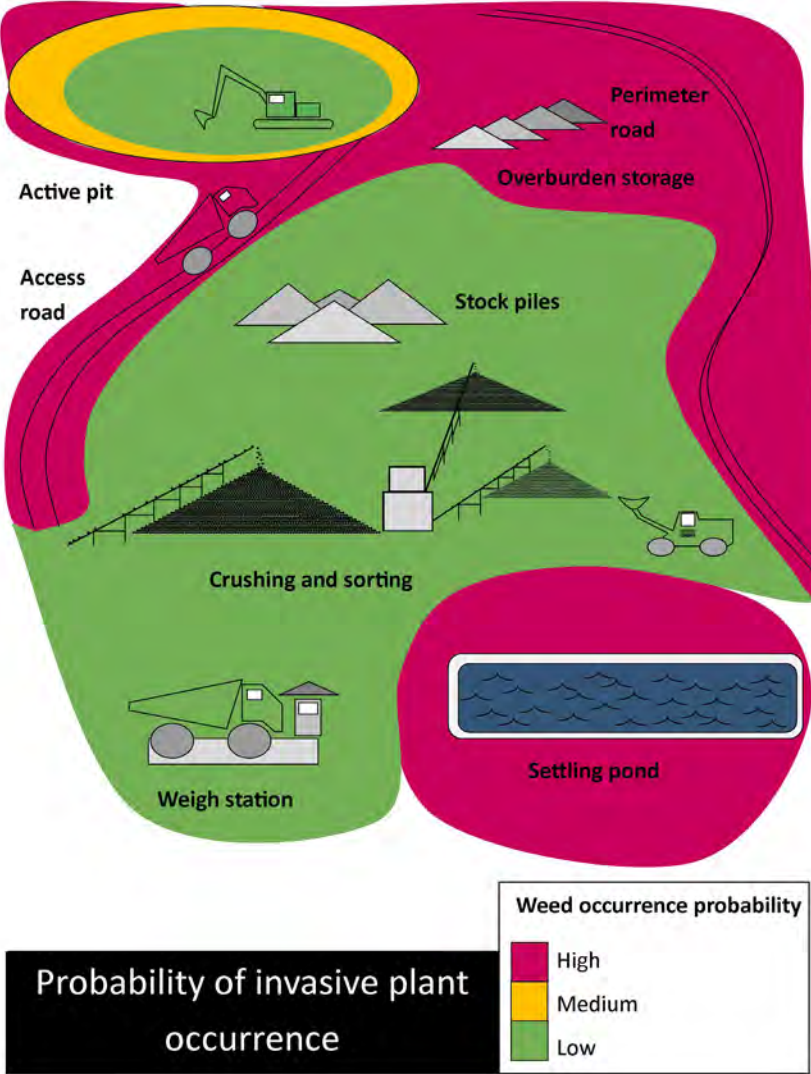
The diagrams on the following pages represent aggregate quarries and show:

- 1) The probability of invasive plant occurrence
- 2) The probability of contamination
- 3) The areas most likely to be contaminated

Each diagram illustrates probability as being either high (red), medium (yellow), or low (green). These hypothetical models of quarries should help guide inspections and treatments. However, quarries and their invasive plant problems differ, and these models will not exactly fit any quarry.

The probability of invasive plant occurrence diagram displays the likelihood of finding invasive plants at a quarry. Disturbance levels and site history dictate invasive plant occurrence at many aggregate pits. The probabilities of invasive plant occurrence are:

HIGH	MEDIUM	LOW
<ul style="list-style-type: none">•Around active pit•Road between pit and crushing/ sorting area•Stock piles•Perimeter roads•Stock piles (inactive)	<ul style="list-style-type: none">•Inside pit perimeter•Settling pond	<ul style="list-style-type: none">•Stock piles (active)•Crushing/sorting area•Weigh station

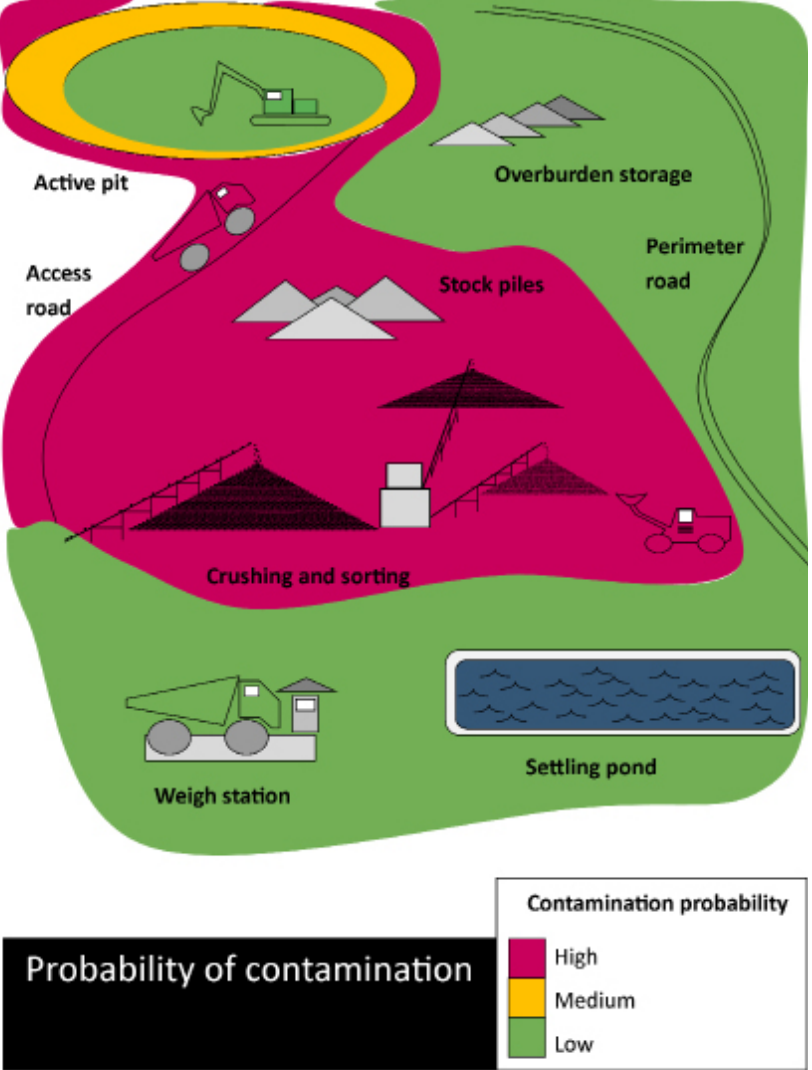


Probability of Contamination

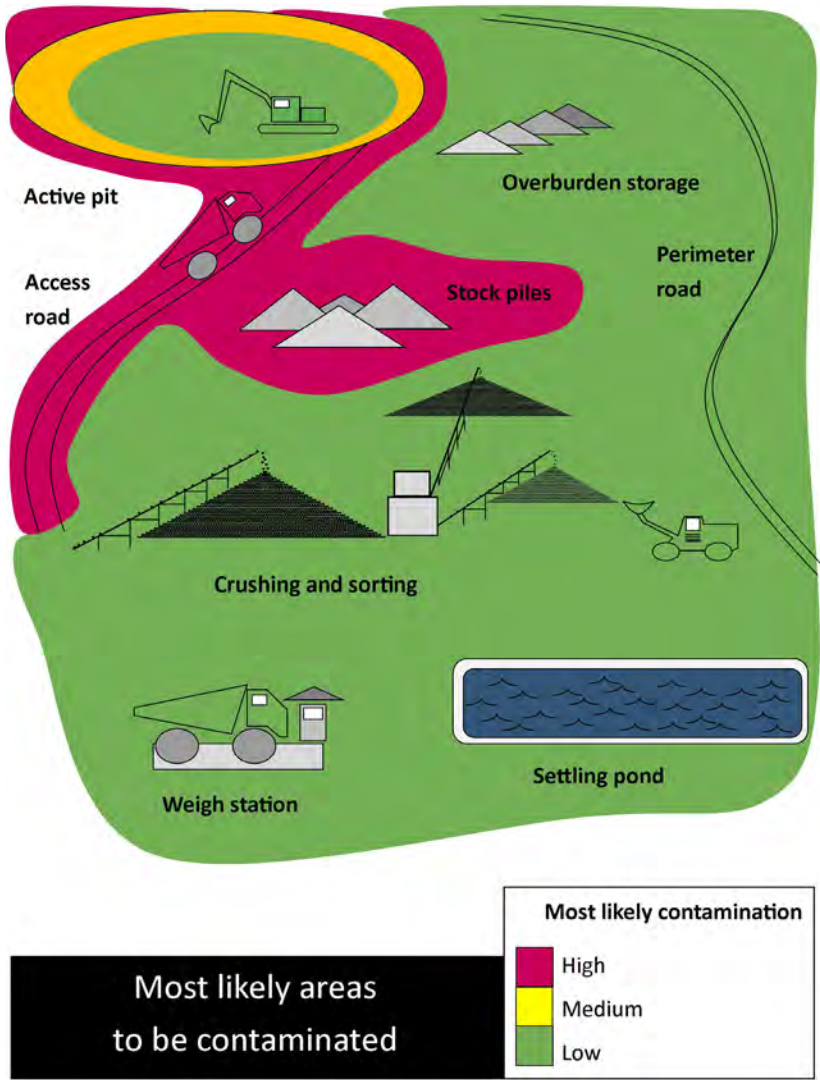
The probability of contamination diagram shows the likelihood that invasive plants, if present, will contaminate exported material. While the probability can be high, if there are no invasive plants, then the contamination is less likely. High probable areas are sites where nearby sources could contaminate exposed aggregate. The probabilities of contamination if invasive plants are present are:

HIGH	MEDIUM	LOW
<ul style="list-style-type: none">•Around active pit•Road between pit and crushing/ sorting area•Stock piles	<ul style="list-style-type: none">•Just inside active pit	<ul style="list-style-type: none">•Center of active pit•Perimeter roads•Settling ponds•Overburden storage

The highest probability areas for contamination are relatively small, but are the most important to monitor and treat for invasive plants. The most likely areas of invasive plant contamination are when the highest probability of occurrence overlaps with the highest probability of contamination. When these areas overlap, quarry managers must take precautions to ensure that aggregate is not contaminated. Quarry managers should prioritize treatments in areas where the probability of contamination is high and invasive plants are present. The areas that are most likely to contaminate material include access roads and the area around pit perimeter. *See diagram, following page.*



Inspection Difficulties



Inspections are difficult and a truly weed-free product may not be realistic. Still inspections can greatly reduce the likelihood that a costly infestation coming from contaminated aggregate will occur. This risk is further reduced if quarry managers actively manage their invasive plants.

Inspectors will not be able to visit every part of the quarry (e.g. too dangerous, too large) and some plants will be missed. To compensate, inspect all areas that are highly likely to contaminate material for sale (see probability maps) and try to get a representative sample of sites and what species are there. For example, if an inspector observes Italian thistle in the outlying area, but does not observe it in the quarry, it is still likely that the long-dispersing Italian thistle seeds could contaminate material and that plants may be in the quarry.

Many species have a long seed life, and it will be impossible to know if seeds are in the material. Monitor sites after using imported aggregate in construction.

Plants with wind-blown seeds are difficult to account for. The distance between invasive plants and saleable material should be greater for long-dispersing plants than short-dispersing plants.

Inspections only give a snapshot in time. Inspections in the spring and fall are advisable to better understand what invasive plants are growing there and to help quarry managers with plant identification.

Glossary of Terms

Active area	Anywhere within a quarry where aggregate are processed or stored: including extraction pit, crushing and sorting facilities and on-site roads
Aggregate	Sand, gravel or crushed stone
Angle of repose	The angle that a pile of unconsolidated material will make without sliding
Conveyor	Moving belt stretched along a ramp and used to pile aggregate
Excavator	Large equipment used for digging. Operator sits in a revolving structure with shovel and arm on one end, and the engine on the other.
Feeder	Short conveyor belts that connect processing equipment
Front-end loader	Tractor/loader with large bucket in front that can be used for digging or loading
Haul truck	Large dump-trucks used to move material within the quarry
Internal access roads	Roads going between the active pit, conveyors, stocks piles and weigh station
Overburden	Soil and mineral material removed to access the mineable material
Perforated screen plates	Screens used to sort various aggregate products
Perimeter roads	Roads on the outside of the pit, rarely driven by large equipment
Settling pond	Basin where wastewater is stored and fine materials sink to the bottom
Scrubber	Removes unwanted material from aggregate by scrubbing and rinsing
Slurry	Mixture of water and sand
Quarry	Open pit mine where sand, gravel, or stone are extracted
Weigh Station	Large scale where dump trucks are weighed before leaving the quarry

This project was made possible by:

Tara Athen
Peter Beesley
Karen Buhr
Heather DeQuincy
Garrett Dickman
Sue Donaldson
Rena Escobedo
Jay Goldsmith
Martin Hutten
Ramona Robison
Bobbi Simpson
Sierra Smith
Jennifer Stern
Wendy West

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